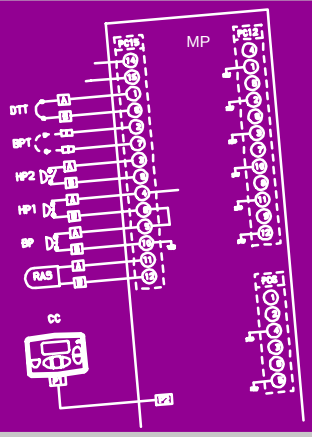
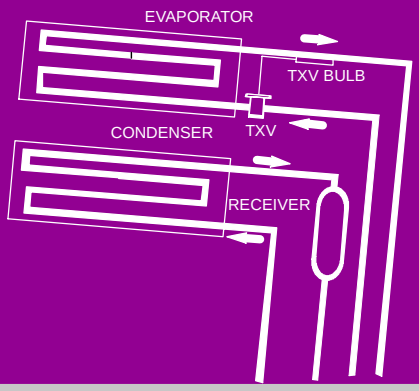
Carrier Truck Refrigeration





OPERATION & SERVICE

for

INTEGRA 40/50S

Truck Refrigeration Units

62-10630 Rev A

Carrier

TRANSICOLD

OPERATION AND SERVICE MANUAL

TRUCK REFRIGERATION UNIT

Integra 40S
Integra 50S

SAFETY SUMMARY

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses. Wear hearing protection as required.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all circuit breakers and the Emergency Switch are turned off, and battery power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the unit. This unit is equipped with Auto−Start in both the road and standby modes. The unit may start at any time. When performing any check of the system make certain the Emergency Switch is in the OFF position.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical control switches. Tag circuit breaker and vehicle ignition to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

When performing any arc welding on the unit or container, disconnect all wire harness connectors from the microprocessor. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO_2 (never use water).

SPECIFIC WARNING AND CAUTION STATEMENTS

To help identify the label hazards on the unit and explain the level of awareness each one carries, an explanation is given with the appropriate consequences:

DANGER − means an immediate hazard which WILL result in severe personal injury or death.

WARNING − means to warn against hazards or unsafe conditions which COULD result in severe personal injury or death.

CAUTION − means to warn against potential hazard or unsafe practice which could result in minor personal injury, product or property damage.

The statements listed below are applicable to the refrigeration unit and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate.

WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

WARNING

Make sure the power plug is clean and dry before connecting to any power source

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY

SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

WARNING

Ensure power to the unit is OFF and power plug is disconnected or vehicle engine is OFF and negative battery cable is disconnected before replacing the compressor.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. (See Figure 4-3.) Cylinder pressure is approximately 2350 psi (160 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur.

CAUTION

If starting unit for the first time after installation the compressor pressure regulating valve will need to be reset (refer to paragraph 4.15)

CAUTION

If starting unit for the first time after installation or starting after adding/removing of an optional feature or if Owners operating parameters have changed the Configuration will need to be reset (refer to paragraph 2.9)

CAUTION

Under no circumstances should anyone attempt to service the microprocessor (see section 4.17). Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

CAUTION

Refrigerant R404A must be charged as a liquid. Refrigerant R404A is a blend. Charging as a vapor will change the properties of the refrigerant.

CAUTION

Do not damage or over tighten the enclosing tube assembly. Also make sure all parts are placed in the enclosing tube in proper sequence to avoid premature coil burn-out.

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SECTION 1

DESCRIPTION

1.1 INTRODUCTION

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate.

This manual contains Operating Data, Electrical Data and Service Instructions for the Carrier Transicold Model 40S and 50S truck refrigeration units listed in Table 1-1.

The unit (Figure 1-1) is of the split system type with the condenser mounted outside the truck body, evaporator mounted in the body, and a CAB COMMAND control center mounted in the drivers compartment. Two types of compressor drive are available:

D Road operation

the compressor is driven by the engine of the vehicle when in operation over-the-road.

D Road/Standby version

With the standby option a second compressor is mounted in the condenser section. This compressor is driven by 230 volt, single or three phase power.

The model/serial nameplate is located inside of the unit on the frame as shown in Figure 1-1.

The condenser section (see Figure 1-2 & Figure 1-3) contains the condenser fan & coil, filter–drier, oil separator, condenser pressure control valve, hot gas valve and microprocessor. On road/standby units the condenser also houses the standby compressor, control box and rectifier/transformer assembly. In addition, single phase units are fitted with a start box which contains the capacitors and relay.

The evaporator assembly consists of the evaporator fans (3 each = 50S, see Figure 1-5; 2 each = 40S, see Figure 1-6), evaporator coil, expansion valve, defrost termination thermostat, compressor pressure regulating valve, heat exchanger, low pressure switch and quench valve.

The control system is a microprocessor controller. Once the controller is set at the desired temperature, the system automatically selects cooling and heating cycles as necessary to maintain the desired temperature with in very close limits.

Table 1-1 Model Chart

Model	R-404A		Road Compressor	Standby Compressor	Condenser Weight		Evaporator Weight
	LB	KG			Road	Road and Standby	
40S	6	2.7	TM 16	06VM306 (3 & 1 phase)	192 lb (87 kg)	320 lb (145 kg)	64 lb (29kg)
50S	6.5	2.9	TM 16	06VM307 (3 phase) 06VM306 (1 phase)			86 lb (39 kg)

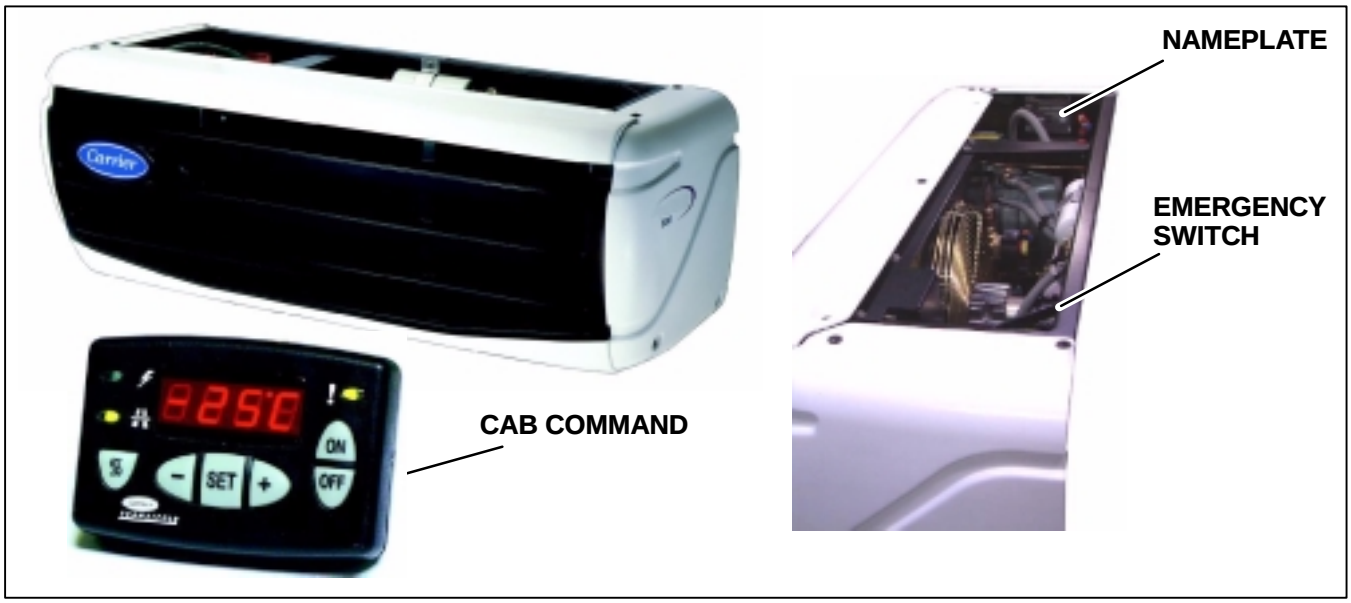
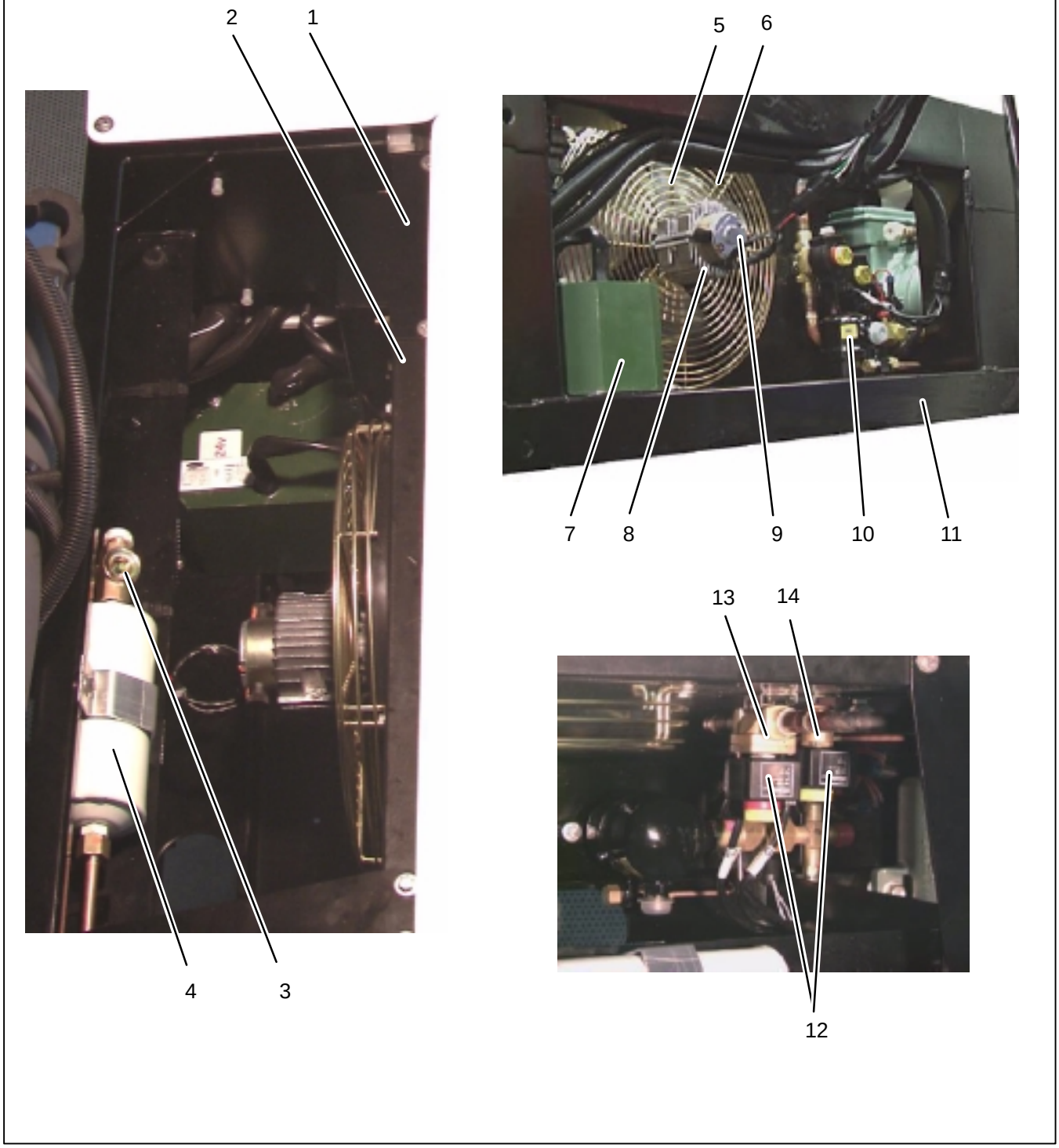
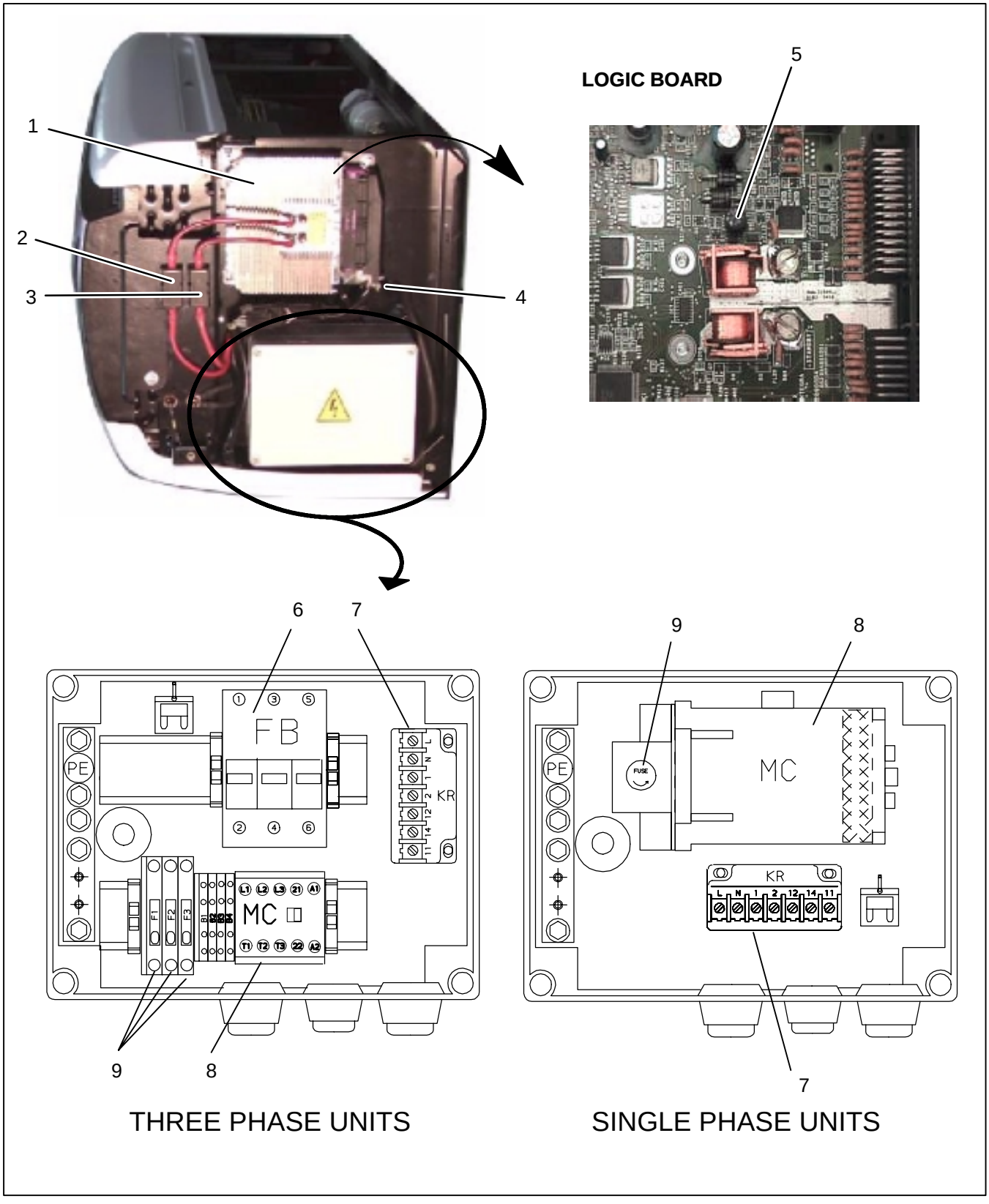


Figure 1-1 Integra 50S



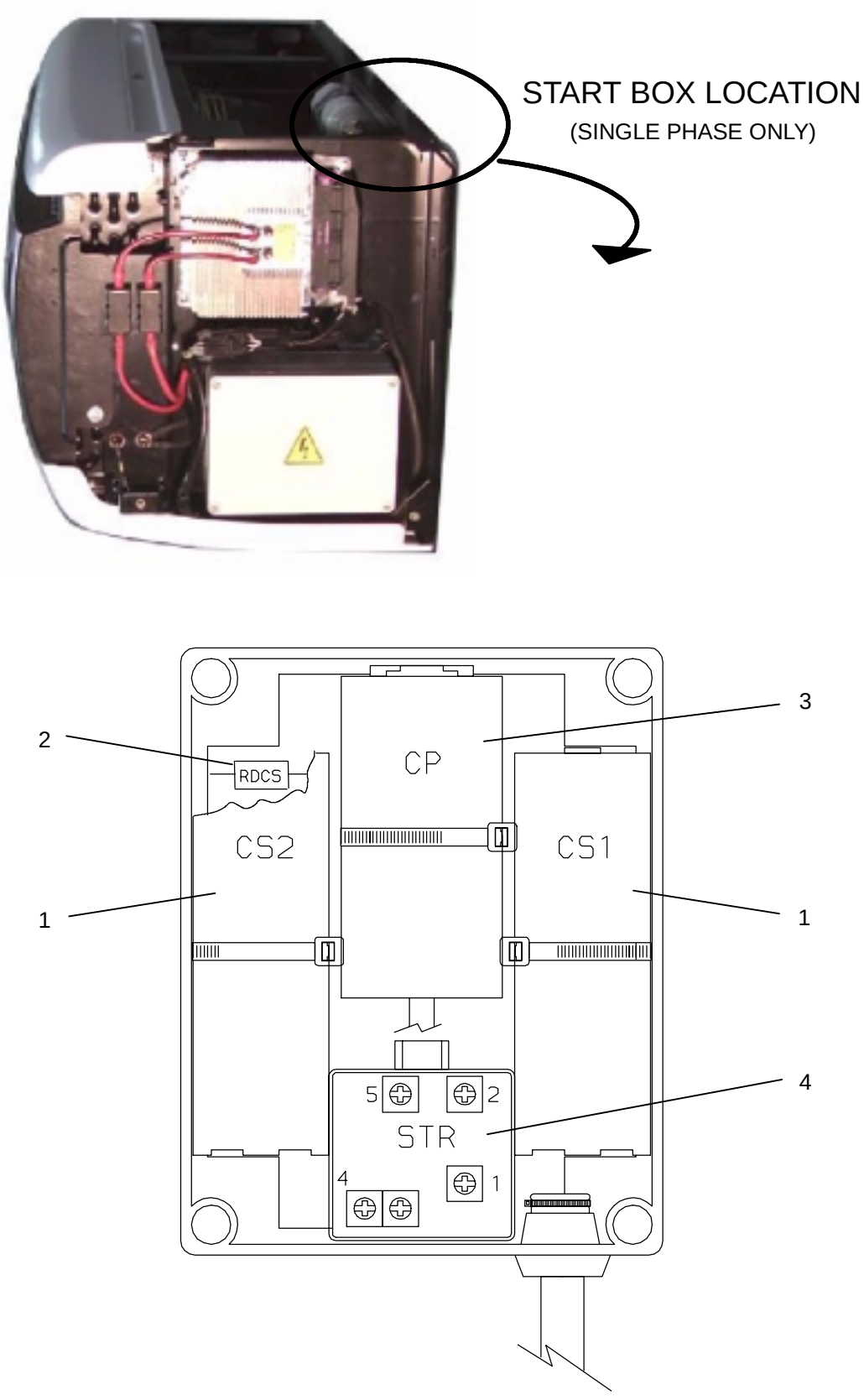
1. Rectifier Bridge Assembly (RB)
2. Condenser
3. Sight Glass
4. Filter–Drier
5. Condenser Fan
6. Fan Guard
7. Transformer (TR)
8. Heat Sink
9. Condenser Fan Motor (CFM)
10. Oil Separator
11. Frame Assembly
12. Solenoid Coil
13. Condenser Pressure Control Valve (HGS2)
14. Hot Gas Valve (HGS1)

Figure 1-2 Condenser



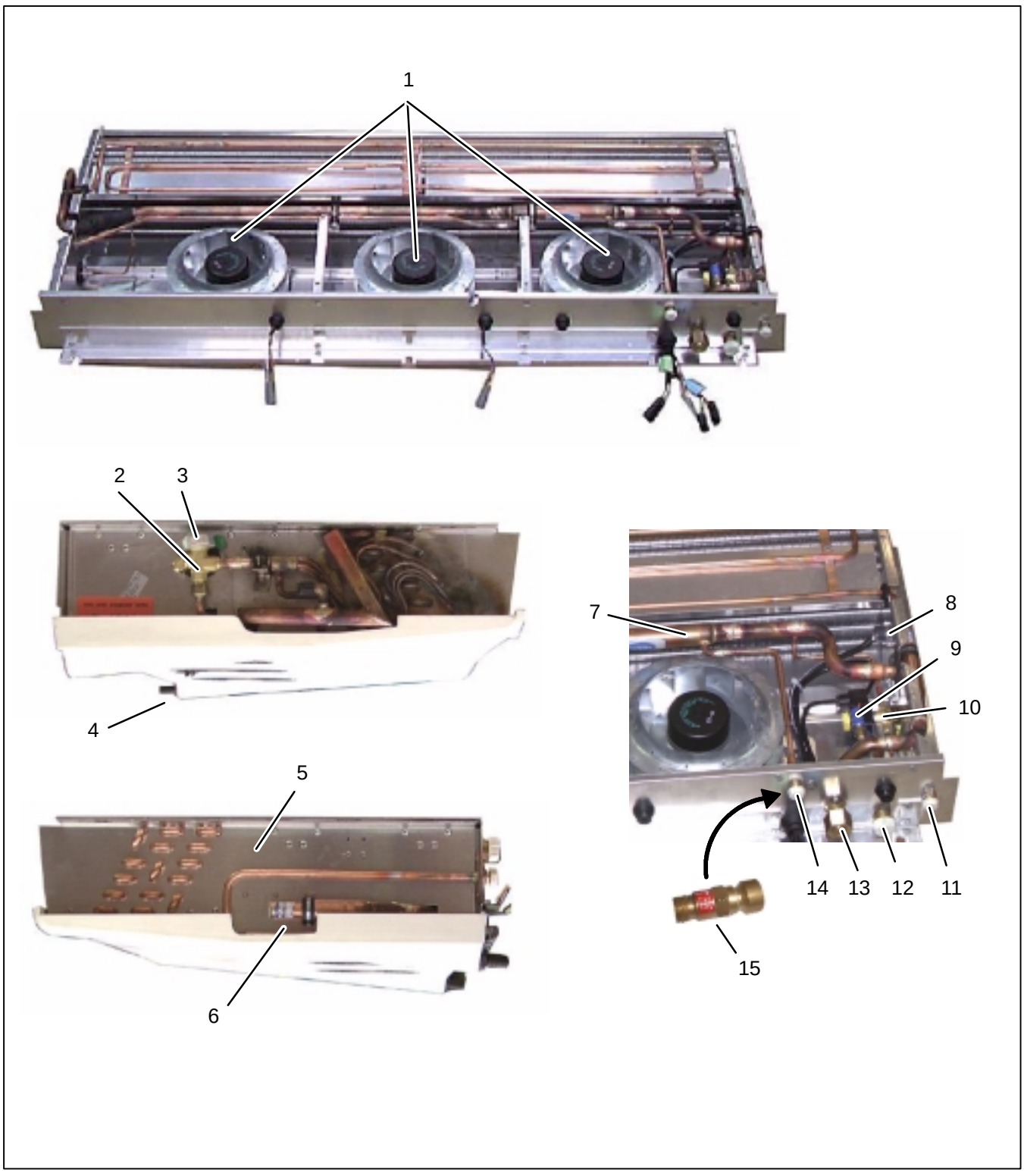
1. Microprocessor
2. Standby Fuse (FS)
3. Road Fuse (FR)
4. Harness
5. 1A Field Replaceable Fuse (12-00526-88) (Starting with Controller S/N 1997)
6. Fused Disconnect (FB) – Three Phase Only
7. Electronic Overload Relay (KR)
8. Standby Contactor (MC)
9. Primary Transformer Fuses (F1,2,3 Three Phase Units – F1 Single Phase Units)

Figure 1-3 Control Box



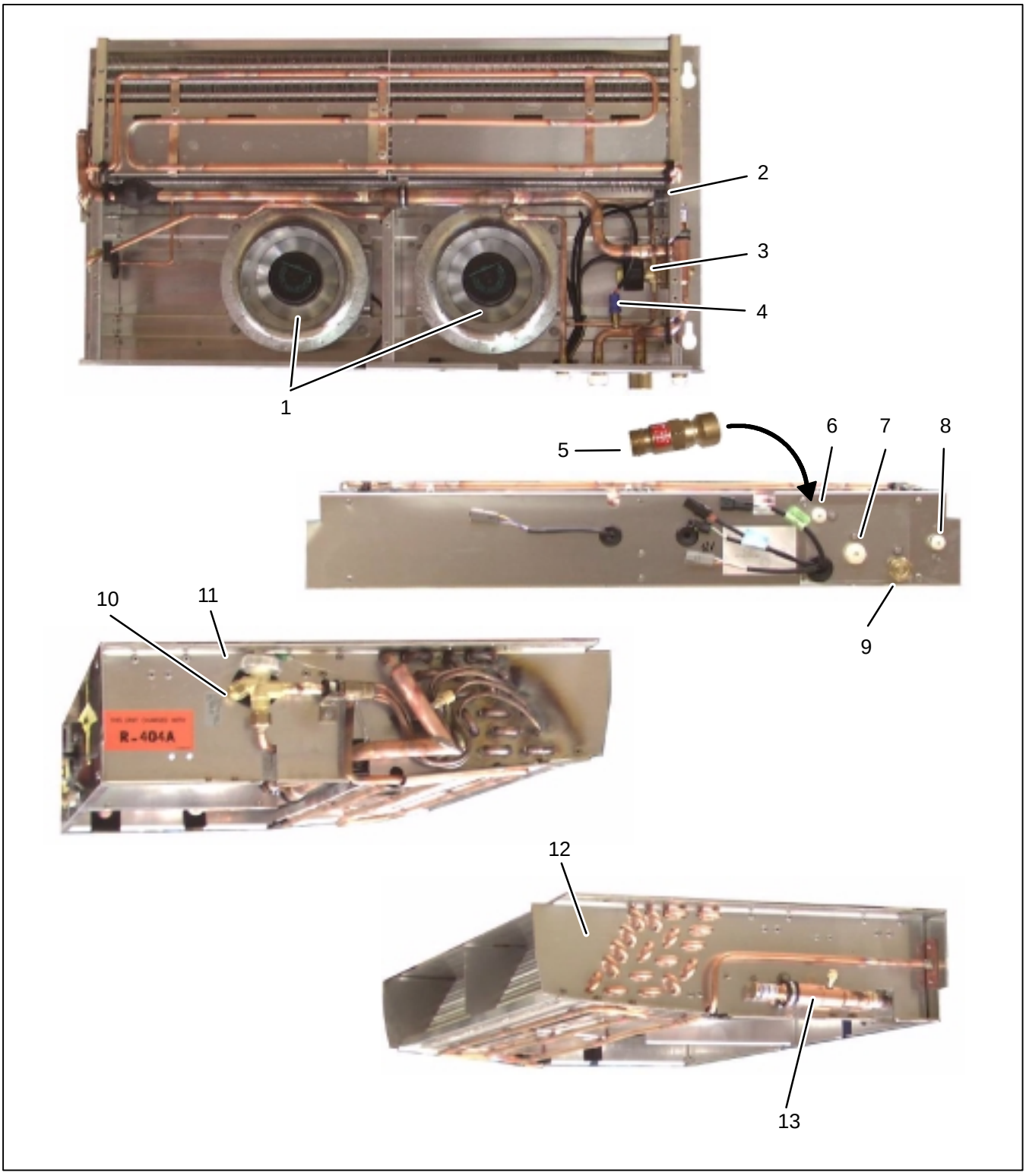
1. Start Capacitor
2. Resistor, Start Capacitor Discharge
3. Run Capacitor
4. Start Relay

Figure 1-4 Start Box (Single Phase Only)



1. Evaporator Fan Motor & Blowers (EFM)
2. Orifice
3. Expansion Valve
4. Water Drain Hose Fitting
5. Evaporator Coil Assembly
6. Compressor Pressure Regulating Valve (CPR)
7. Heat Exchanger
8. Defrost Termination Thermostat (DTT)
9. Low Pressure Switch (LP)
10. Quench Valve
11. Hot Gas Fitting
12. Standby Suction Line Fitting
13. Road Suction Line Fitting
14. Liquid Line Fitting
15. Liquid Line Check Valve

Figure 1-5 Evaporator 3 Fans (Integra 50S)



1. Evaporator Fan Motor & Blowers
2. Defrost Termination Thermostat (DTT)
3. Quench Valve
4. Low Pressure Switch (LP)
5. Liquid Line Check Valve
6. Liquid Line Fitting
7. Standby Suction Line Fitting
8. Hot Gas Line Fitting
9. Road Suction Line Fitting
10. Orifice
11. Expansion Valve
12. Evaporator Coil Assembly
13. Compressor Pressure Regulating Valve (CPR)

Figure 1-6 Evaporator 2 Fans (Integra 40S)

1.2 COMPRESSOR REFERENCE DATA

Model	TM 16	06VM306	06VM307
Displacement	163 cc	113 cc	130 cc
No. Cylinders	6	2	2
Weight	7 kg	37 kg	47 kg
Oil Charge	250 ml	1200 ml	1200 ml
Approved oil	POE – Mobil Arctic EAL 68 (Carrier Part Number 46-60002-02)		

1.3 REFRIGERATION SYSTEM DATA

a. Defrost Timer

Automatic triggering or at present intervals :
0, auto, 1h, 2h, 3h, 4h, 5h, 6h

b. Defrost Termination Thermostat

Opens at: 48_ ¦ 5_F (9_ ¦ 3_C)

Closes at: 37_ ¦ 5_F (3_ ¦ 3_C)

c. High Pressure Switch (HP1)

Cutout at : 465 ¦ 10 psig (32 bar)

Cut-in at : 360 ¦ 10 psig (25 bar)

d. Condenser Pressure Switch (HP2)

Cutout at : 245 ¦ 10 psig1 (7 bar)

Cut-in at : 320 ¦ 10 psig (22 bar)

e. Standby High Pressure Switch (HP3)

Cutout at : 430 ¦ 10 psig (30 bar)

Cut-in at : 360 ¦ 10 psig (25 bar)

f. Refrigerant charge

Refer to Table 1-1.

g. Compressor Pressure Regulating Valve (CPR)

Setting; 36 ¦ 1 psig (2.5 bar)

h. Thermostatic Expansion Valve

Type: **50S** = TES 2/ Orifice n_4/ MOP 75 psi (5.1 bar)
40S = TES 2/ Orifice n_3/ MOP 75 psi (5.1 bar)

Superheat setting = 7 ¦ 1_F(4_C) at 0_F (-20_C) box temperature.

i. Low Pressure Switch (LP)

Cutout at : -2.9 psig ¦ 3 psi (-0.2 bar)

Cut-in at : 14.5 psig ¦ 3 psi (1 bar)

j. Quench Valve (BPV)

Opens at: 260_F (127_C)

Closes at: 212_F (105_C)

1.4 ELECTRICAL DATA

a. Evaporator Fan Motors

Bearing Lubrication	Factory Lubricated
Horse Power	0.1 kw
Operating Amps	7 to 9 amps
Speed	2100 rpm (rated)

b. Standby Compressor Speed

– 1740 rpm – 60 hz

c. Compressor Motor Ratings

UNIT	Voltage	Frequency	Phase	kW	HP	Contactor data			
						MRA*		LRA*	
						230	400	230	400
50S	230 / 400	60 Hz	3	1.491	2	11.8	9.8	45.1	26
	208 / 230	60 Hz	1	1.491	2	15.6	–	78.7	–
40S	230 / 400	60 Hz	3	1.491	2	11.8	9.8	45.1	26
	208 / 230	60 Hz	1	1.491	2	15.6	–	78.7	–

* MRA = Maximum Rotor Amps LRA = Locked Rotor Amps

1.5 TORQUE VALUES

Assembly	Ft–Lbs	N.m	Size
Standby compressor	4.1	5.5	M 10
Evaporator Fan Motor – Bracket	2.2	3	M 4
Condenser – frame	7.4	10	M 6
Condenser Fan – Blade	3.7	5	M 6
Mounting bolts	84.1	114	M 12

1.6 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions by automatically shutting down the unit when such conditions occur. This is accomplished by the fuses listed in Table 1-2 and safety devices listed in Table 1-3.

Table 1-2 Fuses

Item	Rating
Road supply fuse (FR)	50 A
Standby supply fuse (FS) (a)	50 A
Main standby fuse (FB – X3)	16 A
Electric heat fuses (F4/F5/F6) [Future]	6.3 A
Transformer primary fuses (F1/F2/F3)	3.15 A
Main road fuse (FR1) (b)	60 A
Field Replaceable Fuse (c) (Starting with Controller S/N 1997)	1 A

(a) On road / standby unit only

(b) This fuse is located close to the vehicle battery (12 v).

(c) This fuse is located on the logic board inside the microprocessor and protects the microprocessor against reverse polarity on the power supply. (See Figure 1-3).

Table 1-3 Safety Devices – Microprocessor controller

	Unsafe Conditions	Safety Device	Automatic restart with fault cleared	Device setting
1	Excessive drop in pressure	Automatic reset of low pressure switch	YES	Cutout : –2.9 psig (-0.2 bar) Timer 5 mn
2	Excessive current draw on all microprocessor outputs (evaporator and condenser fan)	Electronic relay	YES	Self-protected opening
3	Excessive current draw control circuit	Fuse on electronic board	NO	Self-protected opening
4	Excessive current draw motor compressor	Overload relay	YES	See electrical wiring diagram
5	Excessive compressor discharge pressure	Automatic reset of High pressure switch (HP1, HP3)	YES	Timer 5 mn
6	Excessive current draw unit on standby	Standby fuse	NO	See fuse Table 1-2
7	Excessive current draw unit on road	Road fuse	NO	See fuse Table 1-2
8	Connection error on primary transformer	Fuses	NO	See fuse Table 1-2
9	Excessive compressor motor winding temperature	O.L.P. (overload protector)	YES	Self-protected opening
10	Clutch malfunction - road (excessive current draw)	Electronic relay	YES	Self-protected opening
11	Clutch malfunction - road (insufficient current draw)	Electronic relay	YES	Detection of min. threshold at 750 mA
12	Double power supply (road + standby)	Microprocessor	YES	Display on Cab Command until one of the 2 power supplies have been disconnected.
13	Low battery voltage	Microprocessor	YES	Cutout/cut-in at 10 V

1.7 REFRIGERANT CIRCUIT DURING COOLING

When cooling (See Figure 1-7), the unit operates as a vapor compression refrigeration system. The main components of the system are the reciprocating compressor, air-cooled condenser, thermostatic expansion valve and direct expansion evaporator.

The compressor raises the pressure and temperature of the refrigerant and forces it through the discharge check valve and condenser pressure control valve into the condenser tubes. The discharge check valves prevent reverse flow through the non operating compressor.

When operating on the road compressor, the flow also passes through the oil separator where oil is removed and returned to the compressors.

The condenser fan circulates surrounding air over the outside of the condenser tubes. Heat transfer is thus established from the refrigerant gas (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat. This removal of heat causes the refrigerant to liquefy; liquid refrigerant flows from the condenser to the receiver.

The receiver stores any excess charge due to surges in load on the system and stores refrigerant during low side service.

The refrigerant then flows through the subcooler, filter-drier, sight glass, liquid line check valve (option for 40S) and liquid / gas heat exchanger to the thermostatic expansion valve.

The subcooler and heat exchanger remove additional heat form the liquid to provide improvement in system efficiency. The filter–drier contains an absorbent and filter screen that keeps the refrigerant dry and clean. The sight glass is fitted with an indicator that changes color to indicate moisture content of the refrigerant. The check valve serves to prevent reverse flow of refrigerant during the heating/defrost cycle.

The liquid than enters the thermostatic expansion valve (with external pressure equalizer) which regulates the flow rate of refrigerant towards the evaporator in order to obtain maximum use of the evaporator heat transfer surface.

The evaporator tubes have aluminium fins to increase heat transfer; therefore heat is removed from the air circulated through the evaporator. This cold air is circulated throughout the truck to maintain the cargo at the desired temperature.

The transfer of heat from the air to the low temperature liquid refrigerant causes the liquid to vaporize. The vapor at low temperature and pressure passes back through the heat exchanger then enters the compressor pressure regulating valve (CPR) which regulates refrigerant pressure entering the compressor to prevent overloading of the vehicle engine. From this point, the cycle starts over.

The quench valve (BPV) opens as required to maintain a maximum discharge temperature of 127_C (260°F).

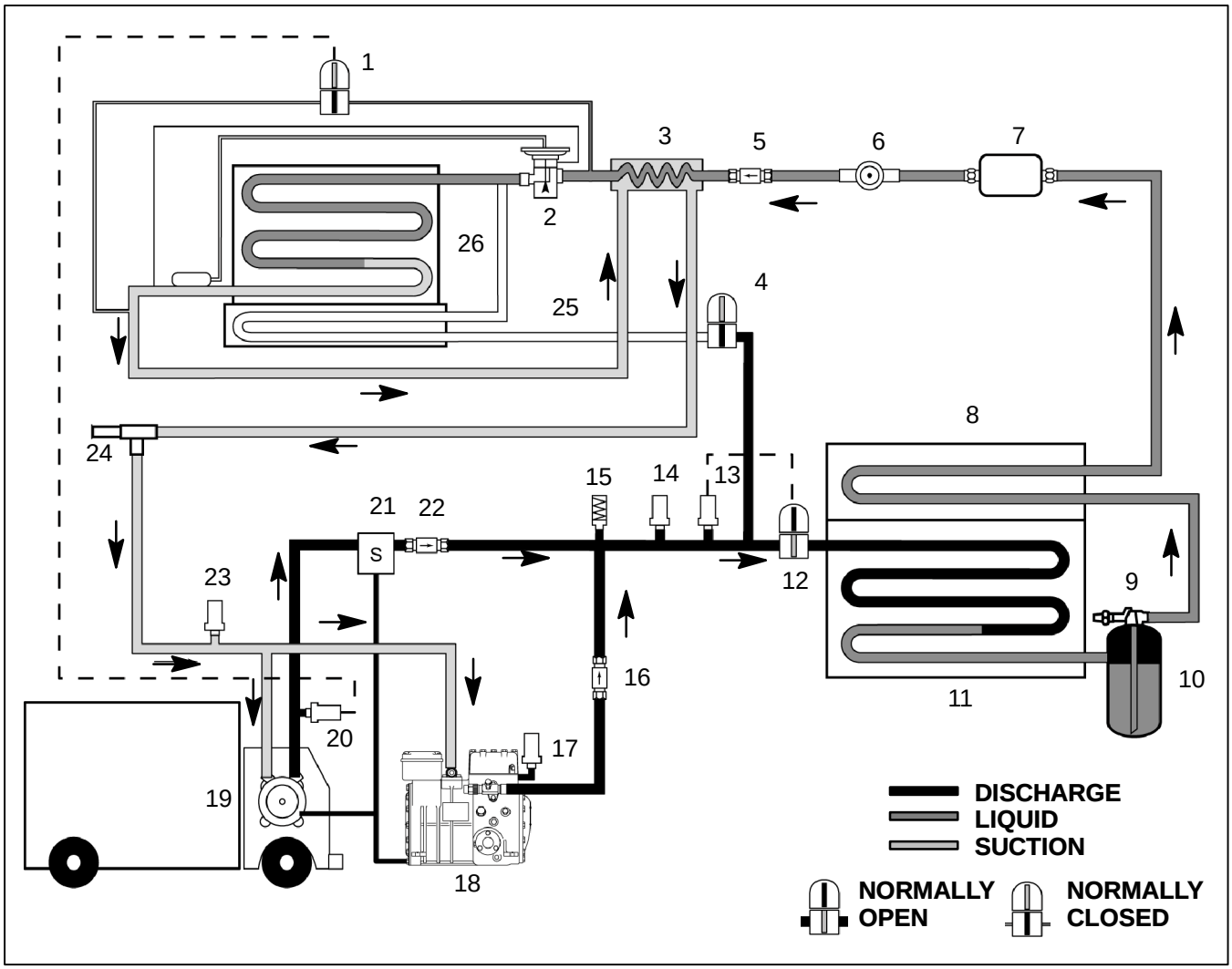
1.8 REFRIGERANT CIRCUIT DURING HEAT AND DEFROST

When refrigerant vapor is compressed to a high pressure and temperature in a compressor, the mechanical energy necessary to operate the compressor is transferred to the gas as it is being compressed. This energy is referred to as the ”heat of compression ” and is used as the source of heat during the heating or defrost cycle (See Figure 1-8).

The main difference between heating and defrosting is that, when in heating mode the evaporator fans continue to run circulating the air throughout the truck to heat the product. When defrosting, the evaporator fans stop, allowing the heated vapor to defrost any ice build-up on the coil.

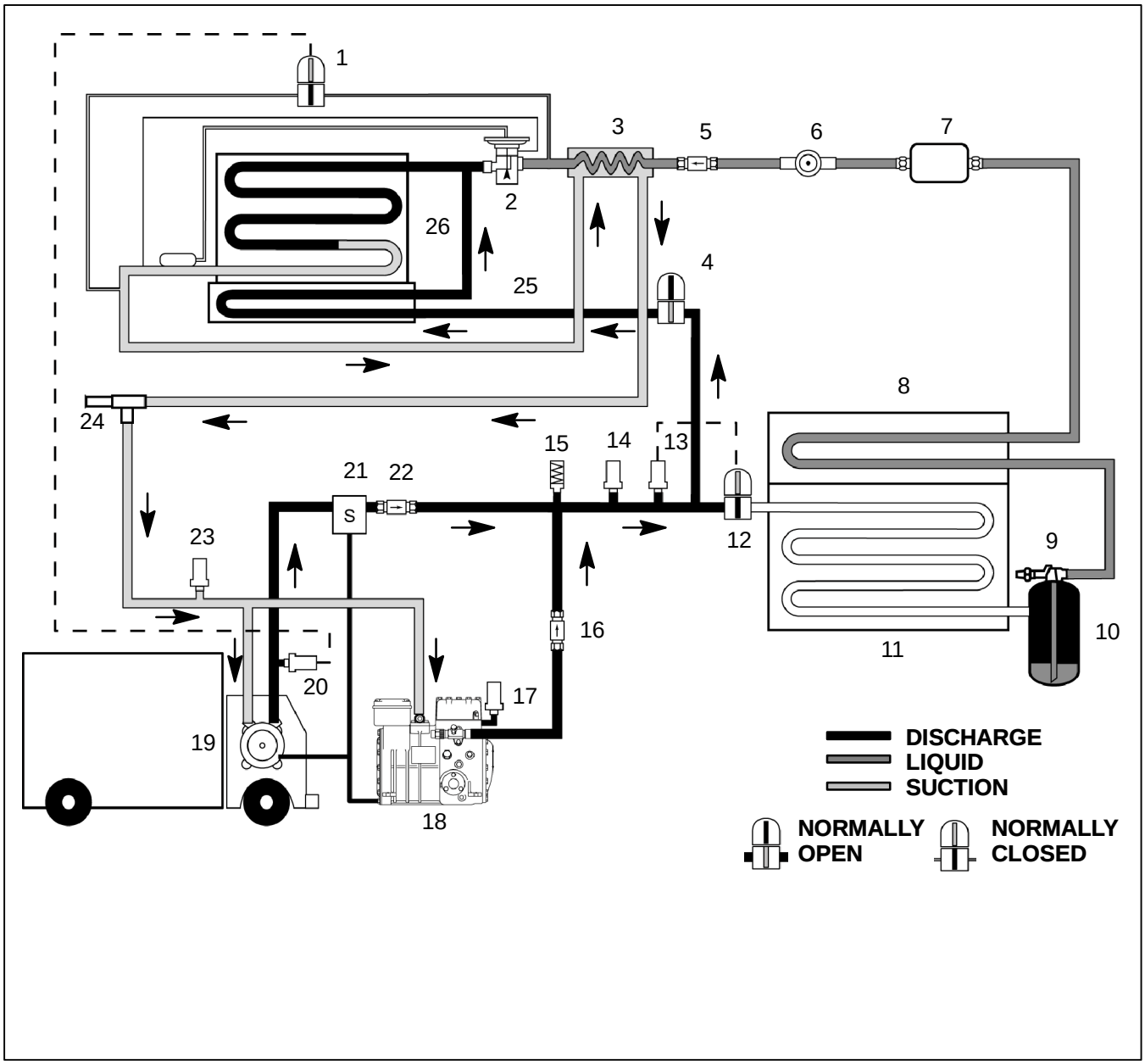
When heating or defrost is required, the hot gas solenoid valve is energized (opened) to allow heated refrigerant vapor to flow directly to the evaporator coil.

The system is fitted with a condenser pressure control valve (see Figure 1-8). The valve closes when pressure is above the setting of the condenser pressure control switch to prevent additional pressure rise in the system. When pressure is below the setting of the condenser pressure control switch, the valve is opened to pressurize the receiver and force additional refrigerant into the system and increase heating capacity.



1 Quench (Liquid Injection) Valve (BPV)
2 Thermostatic Expansion Valve
3 Heat Exchanger
4 Hot Gas Solenoid Valve (HGS1)
5 Liquid Line Check Valve
6 Sight Glass
7 Filter–Drier
8 Subcooler
9 Manual Shut-off Valve (King Valve)
10 Receiver
11 Condenser
12 Condenser Pressure Control Valve (HGS2)
13 Condenser Pressure Control Switch (HP2)
14 High Pressure Switch (HP1)
15 Relief Valve
16 Standby Discharge Check Valve
17 Standby High Pressure Switch (HP3)
18 Standby Compressor
19 Road Compressor
20 Quench (Liquid Injection) Thermostat (BPT)
21 Oil Separator
22 Road Discharge Check Valve
23 Low Pressure Switch (LPS)
24 Compressor Pressure Regulating Valve (CPR)
25 Drain Pan Hot Gas Line
26 Evaporator

Figure 1-7 Cooling Cycle



1 Quench (Liquid Injection) Valve (BPV)
2 Thermostatic Expansion Valve
3 Heat Exchanger
4 Hot Gas Solenoid Valve (HGS1)
5 Liquid Line Check Valve
6 Sight Glass
7 Filter–Drier
8 Subcooler
9 Manual Shut-off Valve (King Valve)
10 Receiver
11 Condenser
12 Condenser Pressure Control Valve (HGS2)
13 Condenser Pressure Control Switch (HP2)
14 High Pressure Switch (HP1)
15 Relief Valve
16 Standby Discharge Check Valve
17 Standby High Pressure Switch (HP3)
18 Standby Compressor
19 Road Compressor
20 Quench (Liquid Injection) Thermostat (BPT)
21 Oil Separator
22 Road Discharge Check Valve
23 Low Pressure Switch (LPS)
24 Compressor Pressure Regulating Valve (CPR)
25 Drain Pan Hot Gas Line
26 Evaporator

Figure 1-8 Heat/Defrost Cycle

SECTION 2

OPERATION

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate.

2.1 INSPECTION

Before starting the truck engine or connecting standby power check the following

a. Check condenser coil for cleanliness

b. Check condition of refrigerant hoses

c. Check condition and tension of compressor belt(s)

d. Check condition of condenser fan blade, motor and brushes

e. Check truck battery fluid level

f. Check truck battery and terminal connections – clean and tighten as necessary

g. Check defrost water drains from evaporator

h. Check evaporator coil for cleanliness

i. Check condition of evaporator fan blades, motor and brushes

j. Check oil level in standby compressor sight glass

2.2 CONNECT POWER

If the unit is to be operated in the stand by mode, connect power as follows:

WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

WARNING

Make sure the power plug is clean and dry before connecting to any power source

a. Check that the external power source corresponds to the characteristics of the unit (see paragraph 1.4 step c.). Make sure external power source circuit breaker is open.

b. Make sure unit is OFF by pressing the OFF button on the Cab Command.

c. Plug the power cord into unit receptacle.

2.3 CAB COMMAND

The Cab Command is mounted remote in the cab. The Command consists of the green and red LED readouts, the keypad and keypad interface (see Figure 2-1).

Figure 2-1 Cab Command

From his seat, the operator can carry out all the control operations :

- automatic start-up in road or standby mode,
- shut-down,
- adjusting the set-point,
- defrost.

Observing the Cab Command, the operator can determine the the box temperature and determine if the set-point is being maintained by checking the LED indicator. The indicator lights up green if the box temperature is within set point and red in the event of a malfunction.

2.3.1 Keypad

The keypad consists of six keys enabling the operator to activate various functions, display operating data and to modify operating parameters.

Display

8888	Readout
	Standby operation LED
	Road operation LED
!	Unit operating data LED - Green : cycling (left-hand side) - Red : malfunction (right-hand side)

Keys

	Manual defrost control key
ON	Unit start-up key

OFF	Unit shut-down key in standby or road mode On road operation, the unit can also be shut down with the ignition key.

Unit data and function modification

SET	The SET key, together with the + and – keys, enables display and modification of unit operating data. The display changes parameter each time the SET key is pressed.
-	Decrement key for selected data
+	Increment key for selected data

2.3.2 Additional Key Functions

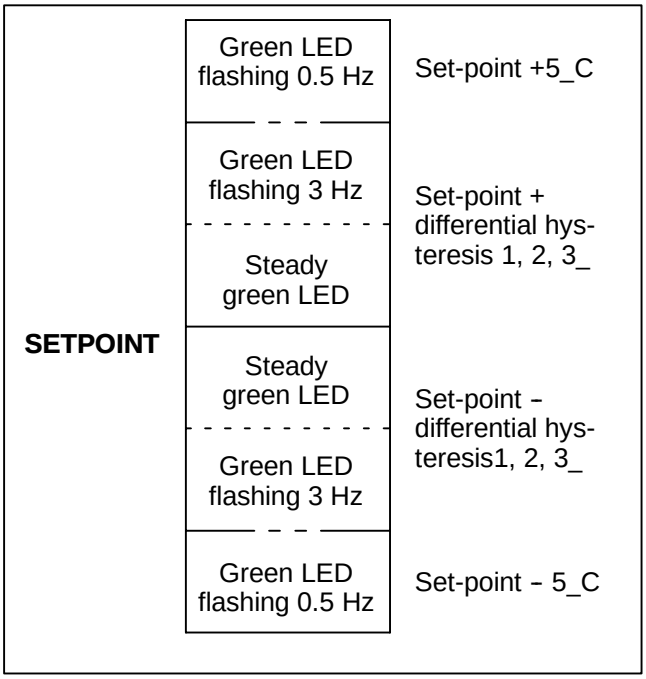
To access additional key functions, press and hold the SET key for 5 seconds. The microprocessor will provide a set of additional functions as the SET key is pressed additional times after the 5 second hold. The sequence for the additional functions is as follows:

SET	Press SET for 5 sec. : this enables access to the alarm codes
- +	Press to display the alarm list
SET	Press again to display software versions
+	Press to display the cab command software version
SET	Press again to display road hourmeter (Road LED ON)
SET	Press again to display standby hourmeter (Standby LED ON)
	Press to display the present intervill between defrosts (min) as calculated by the microprocessor.
	Press to display the elapsed time (min) since the last defrost
SET	Press to return to box temperature

2.3.3 Unit Operating Data LED Status

After an alarm (AXX) has been present for 15 minutes, the red unit operating data LED flashes at 3 Hz. The LED will continue to flash at 0.5 Hz when the temperature goes back within the Set-point range ± differential (steady green LED) and the alarm becomes inactive (PXX).

Under normal operation, the green LED will indicate temperature control status as follows:


SETPOINT
Green LED flashing 0.5 Hz
Set-point +5_C
Green LED flashing 3 Hz
Set-point + differential hysteresis 1, 2, 3_
Steady green LED
Steady green LED
Set-point – differential hysteresis1, 2, 3_
Green LED flashing 3 Hz
Green LED flashing 0.5 Hz
Set-point – 5_C

2.3.4 Digital Display

The digital display consists of 4 alphanumeric characters. The default value displayed is the box temperature. The microprocessor enables selection of the display in degrees Celsius or Fahrenheit.

The display also includes settings for defrost operation (dF). During start up the brightness of the display may be adjusted. to adjust, do the following:

ON	Unit start-up
- +	Press during first 5 seconds the + or – key to increase or decrease the display brightness.

2.4 STARTING

CAUTION

If starting unit for the first time after installation the compressor pressure regulating valve will need to be reset (refer to paragraph 4.15)

CAUTION

If starting unit for the first time after installation or starting after adding/removing of an optional feature or if Owners operating parameters have changed the Configuration will need to be reset (refer to paragraph 2.9)

Depending on desired mode of operation, either start the vehicle engine or close the power source circuit breaker.

	Press the ON key to start the unit (start-up is time-delayed for 40 seconds). The digital display of the cab command displays the box temperature.
	Check the temperature set-point is correct by pressing the SET key; the set-point temperature is highlighted on the digital display.

NOTE

During start up, the evaporator motor speed increases continuously from 0 to 2100 rpm over a 30 seconds time period. Also, the hot gas valve is energized for 40 seconds seconds.

2.5 STOPPING

	Press the OFF key or turn off the ignition key.

2.6 SET-POINT ADJUSTMENT

It is possible to increase or decrease the set-point by whole numbers until the required set-point is displayed. If display stays highlighted, this indicates the set-point displayed has not been validated.

The new setting for the set-point is validated by pressing the SET key.

	Displays the set-point temperature
	Decrease the set-point
	Increase the set-point
	Validates set-point temperature. Returns to display of the box temperature.

2.7 DEFROST CYCLE ADJUSTMENT

Defrost is an independent cycle overriding cooling and heating functions to melt frost and ice from the evaporator when necessary. Defrost may be initiated by the microprocessor or manually by the operator once the defrost termination thermostat has closed at approximately 38°F (3.3°C). In defrost mode, the microprocessor displays “dF” on the cab command and set-point is no longer displayed.

During defrost, the evaporator fans shut down and operation of the condenser fan is controlled by the microprocessor. The end of the cycle is controlled by the opening of the defrost termination thermostat at approximately 48°F (8.9°C).

Defrost parameters may be set to eliminate defrost, decrease the time between defrosts, allow full automatic defrost, increase the time between defrosts or set a forced interval between defrosts. To adjust the defrost cycle, do the following:

	Shut-down unit.
	Display parameters.
	Modify parameters.
	Validate modified settings. Return to display of box temperature.

NOTE

If when settings are adjusted, no key is activated within 5 sec. the system reverts to displaying the box temperature. All validated changes are recorded.

SETTINGS

0 : complete deletion of defrost.

0.5 to 0.9 : decreases time interval between automatic defrost cycles in relation to present calculated time interval.

AUT : automatic defrost optimized by the microprocessor according to the type of cargo transported (variable intervals).

1.1 to 1.5 : increases the time interval between automatic defrost cycles in relation to present calculated time interval.

1 H, 2 H,... 6 H : Forced interval between each defrost expressed in hours.

2.8 SEQUENCE OF OPERATION

General operation sequences for cooling, null, and heating are provided in the following subparagraphs.

2.8.1 Perishable Mode

The unit operates in the perishable mode with set points above 10°F (–12°C)

a. With supply air temperature above set point and decreasing, the unit will be cooling with the compressor and evaporator fans operating. The condenser fan will operate for the first three minutes after start up then operate under the control of the condenser pressure switch (HP2). the green unit operating data led will be flashing then go to a steady illumination as set point is approached.

b. Once temperature decreases to the control point, the unit will enter the null mode with no components operating. If the unit is operating on standby, a 5 minute delay is required before restart is allowed.

c. If temperature increases during the null mode, the unit will restart in cooling.

d. If temperature continues to decrease the unit will enter the heating mode with the with the compressor and evaporator fans operating and the hot gas valve (SV4 energized open). The condenser fan and condenser pressure control valve will operate under the control of the condenser pressure switch (HP2). If the heat option is installed, those heaters will also be energized.

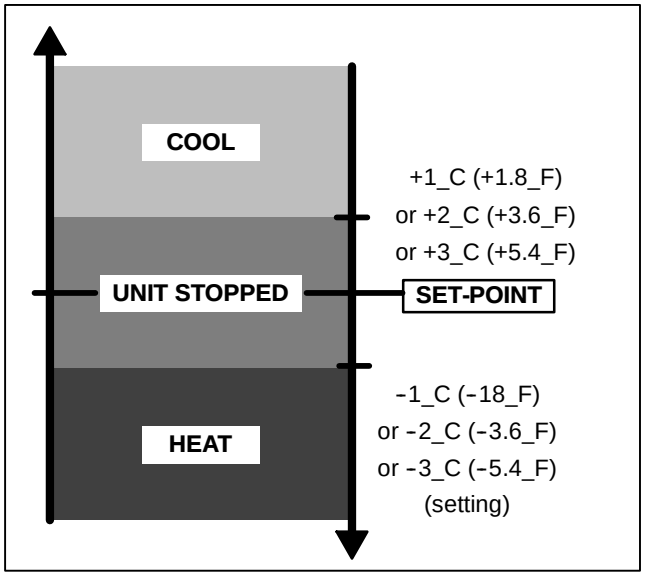
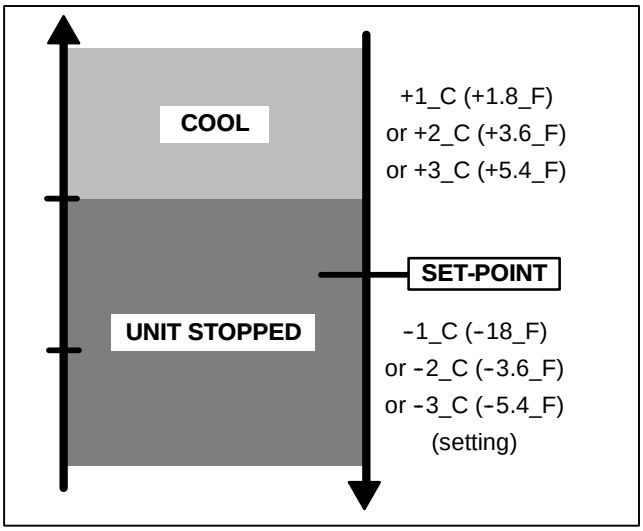


Figure 2-2 Operating Sequence – Perishable Mode

2.8.2 Frozen Mode

The unit operates in the frozen mode with set points at or below 10°F (–12°C). Operation in the frozen mode is the same as in the perishable mode except the heat relays are locked out and no hot gas or electric heating takes place.



2.9 CONFIGURATION

To access the configuration menu, press the **configuration button** (see Figure 2-3) located on the rear of Cab Command. Press the button once only to enter the menu.

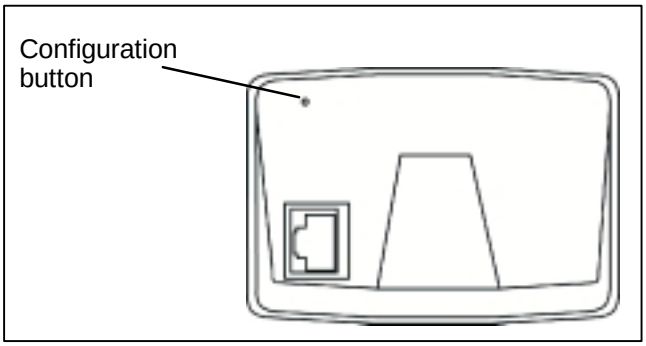


Figure 2-3 Configuration Button

NOTE

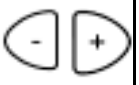
If when settings are adjusted, no key is activated within 5 sec. the system reverts to displaying the box temperature. **All changes made are recorded with OFF/ON**.

	TEMPERATURE UNIT **Ut_C : Celsius degree display** **Ut_F : Fahrenheit degree display**
	Press the + and – keys to change Ut_C or Ut_F.
	Press the SET key to validate.

UNIT VOLTAGE

PS12 : unit voltage 12 V

PS24 : unit voltage 24 V



Press the + and – keys to change PS12 or PS24.

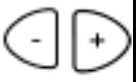
Press the SET key to validate.

NUMBER OF EVAPORATOR FAN

FAn1 : 1 fan

FAn2 : 2 fans

FAn3 : 3 fans



Press the + and – keys to change FAn1, FAn2 or FAn3.

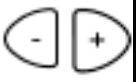
Press the SET key to validate.

FAN SPEED

SPd– : 1st speed mini

SPd= : 2nd speed medium

SPd ≡ : 3rd speed maxi



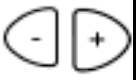
Press the + and – keys to change SPd–, SPd= or SPd ≡

Press the SET key to validate.

2 or 3 ET MODE

2 Et : cool, null

3 Et : cool, null, heat



Press the + and – keys to change 2 Et or 3 Et.

Note : 50S : 3 Et

40S without condenser closing valve : 2 Et

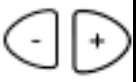
40S with condenser closing valve : 3 Et

Press the SET key to validate.

OPTIONAL ROAD HEATING KIT

hrOF : option road heating kit not installed

hrOn : option road heating kit installed



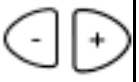
Press the + and – keys to change hrOF or hrOn.

Press the SET key to validate.

OPTIONAL STANDBY HEAT KIT

hSOF : standby heating kit not installed

hSOn : standby heating kit installed



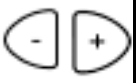
Press the + and – keys to change hrOF or hrOn.

Press the SET key to validate.

DRAIN LINE HEATER

drOF : drain heater (option) not installed

drOn : drain heater (option) installed



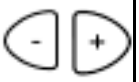
Press the + and – keys to change drOF or drOn.

Press the SET key to validate.

DOOR SWITCH

dOFF : door switch (option) not installed

d On : door switch (option) installed



Press the + and – keys to change dOFF or d On.

Press the SET key to validate.

2.10 ALARM DISPLAY

In the event of a malfunction the unit will be shut down and the Cab Command will display an error message or alarm message. The message will remain displayed until the malfunction is corrected. If standby power is connected and the malfunction is such that standby operation can be allowed, the unit will start in the standby mode. Error messages are provided in Table 2-1 while a listing of the alarm codes is provided in Table 2-2.

Table 2-1 Error Messages

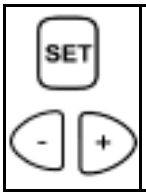
EE	Malfunction : evaporator temperature probe
bAt	Low battery voltage low alarm (Refer to paragraph 2.10.1)
≡≡≡	Twin power supply (road and standby)
Err	Incorrect set-point setting
- - -	Setpoint lower than maximum setpoint but in the range –29_C/+30_C

2.10.1 Low Battery Voltage Alarm

If the battery voltage drops below 10 V the unit shuts down and the cab command displays the message “bAt”. Unit restart is automatic and time-delayed if the voltage rises to the normal level.

2.10.2 Accessing Alarm Messages

Current alarms will be displayed with an “A” preceding the alarm number while past alarms will be displayed with a “P” preceding the alarm number. To access the alarm messages:

	Press SET for 5 seconds : enables access to alarm messages. In the event of more than one alarm, press the + and – keys to list them.

2.10.3 Clearing Alarm Messages

The alarm list provides information on current alarms and past alarms which may be helpful in trouble shooting unit problems. Once all the alarm information has been noted and service is complete, the alarm list may be cleared. To clear the alarm messages:

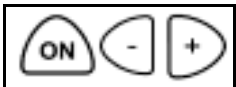
	Press the ON, the + and the – keys at the same time.

Table 2-2 Alarm Messages

A00	No malfunction. Unit in operation.
A01	Low pressure switch (LPS) open (Road)
A02	High pressure switch (HP1) open
A03	Standby compressor thermal overload (PTC) open
A04	Road compressor clutch (CLHR) mal-function
A05	Standby contactor (MC) high amp draw
A06	Condenser fan motor (CFM) high amp draw
A07	Fan Speed Alarm
A08	Hot water solenoid valve (HWV) high amp draw (option)
A09	Hot gas valve (HGS1) high amp draw
A10	Quench solenoid valve (BPV) high amp draw
A11	Condenser pressure control valve (HGS2) high amp draw
A12	High temperature alarm
A13	Low temperature alarm

Table 2-2 Alarm Messages – Continued

A 14	Defrost cycle > 45 minutes
A 15	Setpoint adjusted out of the range –29°C/+30°C
A 16	Evaporator drain line heater (DWR) malfunction
A 17	Transformer/Rectifier thermal overload (RBT) open
A 18	Control fault, electric heat (Future)
A 19	Control fault, multi–temp liquid line valve (Future)
A 20	Low pressure switch (LPS) open (Standby)
A 21	Compressor contactor (MC) open circuit
A 22	Condenser fan motor (CFM) open circuit
A 23	Hot water solenoid valve (HWV) open circuit
A 24	Hot gas valve (HGS1) open circuit
A 25	Quench valve (BPV) open circuit
A 26	Condenser Pressure Control Valve (HGS2) open circuit
A 27	Evaporator drain line heater (DWR) open circuit
A 28	Relay fault, electric heat (Future)

SECTION 3

TROUBLESHOOTING

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

CAUTION

Under no circumstances should anyone attempt to service the microprocessor (see section 4.17). Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

3.1 INTRODUCTION

Under normal circumstances, unit problems will be indicated by an active or inactive alarm in the alarm list. Suggested troubleshooting actions for each alarm indication are provided in Table 3-1. Suggested corrective actions for mechanical type problems are listed under subject headings in Table 3-2.

Table 3-1 Alarm Indications

ALARM	Description	CORRECTIVE ACTION	Reference Paragraph
A00	No Malfunction	All components functioning normally	--
A01	Low Pressure Switch (LPS) Open (Road)	Unit undercharged	4.10.1
		Liquid line filter-drier restricted	4.5
		TXV strainer plugged with foreign material/ice.	4.6
		TXV malfunction	4.16
		Verify operation of evaporator fans.	--
		Failed switch	4.12.2
A02	High Pressure Switch (HP1) Open	Unit overcharged	4.10.1
		Verify operation of condenser fan	--
		Noncondensibles in system	4.7.1
		Discharge check valve failed closed (standby or road)	Replace
		Failed switch	4.12.2
A03	Standby Compressor Thermal Overload (PTC) open	Check liquid injection valve	
		Electric line voltage low	1.4
A04	Road Compressor Clutch (CLHR) Malfunction	Current draw of road clutch coil either high or low	Replace
A05	Standby Contactor (MC) high amp draw	Current draw of contactor coil high or low (0.2 amps - 3 phase; 0.5 amps - 1 phase)	--
		Verify plunger moves freely	--
		Replace contactor	--
A06	Condenser Fan Motor (CFM) high amp draw	Verify motor rotates freely	--
		Verify condition of brushes	4.13
		Replace motor	--
A07	Evaporator Fan Speed	Verify microprocessor configuration	2.9
		Check fan motor output wires	--
A08	Hot Water Solenoid (HWV) high amp draw	Current draw of coil high or low	--
		Replace coil	--

Table 3-1 Alarm Indications – Continued

ALARM	Description	CORRECTIVE ACTION	Reference Paragraph
A09	Hot Gas Valve (HGS1) high amp draw	Current draw of coil high or low (approx 1.6 amp)	––
		Replace coil	4.14.1
A10	Quench Valve (BPV) high amp draw	Current draw of coil high or low (approx 1.2 amp)	––
		Replace coil	4.14.1
A11	Condenser Pressure Control Valve (HGS2) high amp draw	Current draw of coil high or low (approx 1.6 amp)	––
		Replace coil	4.14.1
A12	Out–of–Range – High Temperature	Unit out of range for 15 minutes	Verify Setting
		Verify cooling operation of unit	––
		Hot gas solenoid open	4.14
A13	Out–of–Range Low Temperature	Unit out of range for more than 15 minutes	Verify Setting
		Verify heating operation of unit	––
		Heating option not active (Set Configuration)	2.9
A14	Defrost Cycle >45 minutes	Unit terminated defrost after 45 minutes	––
		Verify HGS1/HGS2 valve operation	4.14
A15	Setpoint out of range	Operator entered invalid setpoint (outside of range)	2.6
		Verify configuration settings	2.9
A16	Evaporator drain line heater (DWR) malfunction	Replace heater	––
A17	Transformer/Rectifier Thermal Overload (RBT) Open	Line voltage low	Correct
		Transformer winding open	Replace
		High load on rectification system	Correct
A18	Electrical Heating Relay (Future)	Relay shorted	Replace
		Wiring shorted	Correct
A19	Multi–Temp Liquid Solenoid Valve (high amps draw) [Future]	Valve coil shorted	Replace
		Wiring shorted	Correct
A20	Low Pressure Switch (LPS) Open (Standby)	Unit undercharged	4.10.1
		Liquid line filter–drier restricted	4.5
		TXV strainer plugged with foreign material/ice.	4.6
		TXV malfunction	4.16
		Verify operation of evaporator fans	––
		Failed switch	Replace
A21	Compressor Contactor (MC) Open Circuit	Contactor coil open circuit	Replace
		Wiring to coil open	Check
A22	Condenser Fan Motor (CFM) Open Circuit	Condenser fan motor defective	4.13
		Wiring to motor open	Check
A23	Hot Water Solenoid Valve (HWV) Open Circuit	Valve coil shorted	Replace
		Wiring to coil open	Check
A24	Hot Gas Valve (HGS1) Open Circuit	Valve coil shorted	4.14.1
		Wiring to coil open	Correct
A25	Quench Valve (BPV) Open Circuit	Valve coil shorted	Replace
		Wiring to coil open	Correct
A26	Condenser Pressure Control Valve (HGS2) Open Circuit	Valve coil shorted	4.14.1
		Wiring to coil open	Correct
A27	Evaporator Drain Line Heater (DWR) Open Circuit	Evaporator drain heater shorted	Replace
		Verify wiring to heater	Correct
A28	Heating Relay (EHR) Open Circuit (Future)	Relay open circuit	Replace
		Wiring to coil open	Correct

Table 3-1 Alarm Indications – Continued

ALARM	Description	CORRECTIVE ACTION	Reference Paragraph
EE	Return Air Sensor	Return air sensor defective	Replace
bAt	Low Battery Voltage	Vehicle battery voltage low	Correct
bAt	Low Battery Voltage	Check alternator system	--
--- --- ---	Using Road & Standby operation at the same time.	If operating on road, disconnect standby power supply	--
		If operating on standby, shut down vehicle engine.	--
Err	Setpoint above maximum.	Programming error, reset.	2.6
---	Setpoint below minimum.	Programming error, reset.	2.6

Table 3-2 Mechanical Indications

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.2 REFRIGERATION **3.2.1 Unit Will Not Cool**		
Compressor malfunction	Compressor drive (clutch) defective Compressor defective	Replace 4.11
Refrigeration system	Defrost cycle has not terminated Abnormal pressure Hot gas solenoid malfunction (HGS1)	3.2.5 3.2.6 4.14
3.2.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor defective	4.11
Refrigeration system	Abnormal pressure Expansion valve malfunction No or restricted evaporator airflow	3.2.6 3.2.10 3.2.9
3.2.3 Unit Operates Long or Continuously in Cooling		
Box	Hot Load Defective box insulation or air leak	Insufficient pull down time Correct
Refrigeration system	Abnormal pressure Temperature controller malfunction	3.2.6 3.2.8
Compressor	Defective	4.11
3.2.4 Unit Will Not Heat or Heating Insufficient		
Refrigeration	Abnormal pressure Temperature controller malfunction Hot gas solenoid malfunction (HGS1)	3.2.6 3.2.8 4.14
Compressor	Compressor drive (clutch) defective Compressor defective	Check 4.11
3.2.5 Defrost Malfunction		
Automatic defrost will not initiate	Defrost thermostat (DTT) open or defective Hot gas valve malfunction Defrost disabled through cab command	Replace 4.14 2.7
Manual defrost will not initiate	Microprocessor defective Defrost thermostat (DTT) open or defective	Replace Replace
Defrost cycle initiates but does not defrost	Hot gas solenoid malfunction (HGS1) Condenser Pressure Control valve malfunction (HGS2)	4.14 4.14
Frequent defrost	Wet load Defrost settings set to low.	-- 2.7
Does not terminate or cycles on defrost	Defrost thermostats (DTT) shorted closed	Replace

Table 3-2 Mechanical Indications – Continued

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.2.6 Abnormal Pressure **3.2.6.1 Cooling**		
High discharge pressure	Condenser coil dirty Noncondensibles or refrigerant overcharge Condenser fan/motor defective	4.4 4.10.1 4.13
Low discharge pressure	Compressor defective Hot gas solenoid malfunction Low refrigerant charge	4.11 4.14 4.10.1
High suction pressure	Compressor defective Hot gas solenoid malfunction Compressor pressure regulator misadjusted (CPR)	4.11 4.14 4.15
Low suction pressure	Filter–drier partially plugged Low refrigerant charge Expansion valve malfunction No evaporator air flow or restricted air flow Excessive frost on coil	4.5 4.10.1 3.2.10 3.2.9 Check
Suction and discharge pressures tend to equalize when unit is operating	Compressor defective Hot gas solenoid malfunction	4.11 4.14
3.2.6.2 Heating		
High discharge pressure	Overcharged system Condenser fan or HP2 pressure switch defective Noncondensibles in system Condenser motor/fan defective	4.10.1 4.12 4.7.1 4.13
Low discharge pressure	Compressor defective Hot gas valve malfunction	4.11 4.14
Low suction pressure	Low refrigerant charge Compressor pressure regulating valve misadjusted (CPR) Condenser Pressure Regulating valve fault (HGS2)	4.10.1 4.15 4.14
3.2.7 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten 4.11 4.11 3.2.10 Check
Condenser or evaporator fan	Loose shroud Bearings defective Fan loose on shaft Bent shaft	Check Check Check
3.2.8 Cab Command Malfunction		
Cab Command non–operational	Fuse open Microprocessor malfunction Microprocessor/Cab command cable	Replace Replace Check
3.2.9 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Heavy frost on coil Coil dirty	Check 4.3
No or partial evaporator air flow	Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in box Fan motor(s) malfunction	Check Check Check Replace

Table 3-2 Mechanical Indications – Continued

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.2.10 Expansion Valve		
Low suction pressure with high superheat	Low refrigerant charge External equalizer line plugged Ice wax, oil or dirt plugging valve strainer Broken capillary Superheat setting too high	4.10.1 Repair 4.6 Repair 4.16.2
Low superheat and liquids lugging in compressor	Superheat setting too low External equalizer line plugged Pin and seat of expansion valve eroded or held open by foreign material	4.16.2 Repair 4.16
Fluctuating suction pressure	Improper bulb location or installation Insulation missing from sensing bulb Low superheat setting	4.16 Replace 4.16.2
High superheat	Expansion valve setting	4.16.2
3.2.11 Malfunction Hot Gas Solenoid or Condenser Pressure Regulating Valve		
Valve does not function properly	No power to valve Improper wiring or loose connections Valve improperly assembled Coil or coil sleeve improperly assembled Movement of plunger restricted due to: a. Corroded or worn parts b. Foreign material lodged in valve c. Bent or dented enclosing tube	Check Check 4.14
Valve shifts but refrigerant continues to flow	Foreign material lodged under seat Defective seat	4.14
3.2.12 Standby Compressor Malfunction		
Standby compressor fails to start	Motor contactor defective Motor Overload open Improper power supply 5–minute timer active	Replace Check Correct Check
Standby motor starts, then stops	Motor Overload open	Check

SECTION 4

SERVICE

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

4.1 PREVENTATIVE MAINTENANCE

Regular servicing is required in order to optimize the life and reliability of your unit. The recommended scheduled maintenance intervals and categories are provided in Table 4-1 while descriptions of the service procedures to be carried out under each category are provided in Table 4-2

Table 4-1 Preventive Maintenance schedule

Hours	Service A	Service B	Service C	Service D
100	G			
1000	G	G		
2000	G	G	G	
3000	G	G		
4000	G	G	G	G
5000	G	G		
6000	G	G	G	
7000	G	G		

Table 4-2 Service Category Descriptions

Service A	1. Check the tension of the alternator belt(s). 2 .Check that the vehicle engine idles correctly with unit operating. Check compressor mounting hardware and belt tension. (Paragraph 4.2) 3 .Check the tightness of bolts and screws and that the unit is correctly fastened onto the box.
Service B	1 . Clean condenser & the evaporator. (Paragraphs 4.3 & 4.4) 2. Replace the road compressor belt(s). 3. Check and if required Replace the filter-drier. (Paragraph 4.5) 4. Clean the TXV orifice filter. (Paragraph 4.6) 5. Check standby compressor oil level. Level should be from 1/4 to 1/2 sight glass.
Service B (Cont'd)	6. Check standby compressor oil level. Level should be from 1/4 to 1/2 sight glass. 7. Check the operation of cab command. 8. Check the defrost DCut-in DFan shut-down DCut-out DDefrost water drain 9 .Check the water tightness of the emergency switch cap.
Service C	1 .Check the bearings of the belt tension pulley. If a spring is fitted, change spring. 2. Change the shockmounts (if any) installed on the road compressor mounting kit. 3. Check the operation of the evaporator and condenser fans. Change the condenser motor brushes. The evaporator of this unit is equipped with brushless fan motors therefore, brush maintenance is not required.. 4. Change the compressor oil. Use polyol ester oil (POE) approved by CARRIER. Refer to paragraph 1.2.
Service D	1. Change the removable fuses and capacitor (if any) in the control box.

4.2 BELT MAINTENANCE AND ADJUSTMENT

A belt tension gauge provides an accurate and easy method of adjusting belts to their proper tension. Properly adjusted belts give long lasting and efficient service. Too much tension shortens belt and bearing life, and too little tension causes slippage and excessive belt wear. It is also important to keep belts and sheaves free of any foreign material which may cause the belts to slip.

The Belt Tension gauge can be used to adjust all belts. The readings which we specify for Carrier Transicold units are applicable only for our belts and application, as the tension is dependent on the size of the belt and distance between sheaves. When using this gauge, it should be placed as close as possible to the midpoint between two sheaves.

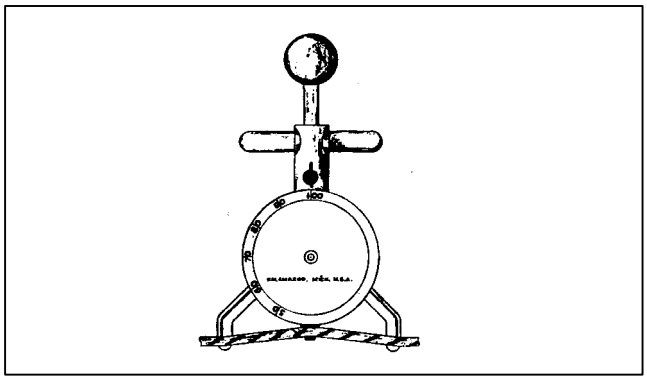


Figure 4-1. Belt Tension Gauge
(Carrier part Number 07−00203−00)

Belt tension depends on each kit. Refer to Installation Instructions provided with the kit for belt tension requirements. In each kit installation instruction, we indicate the belt tension (given with belt tension gauge P/N 07-00203-00.

When installing a new V-belt the tension should be somewhat higher than specified and readjusted after allowing the unit to run for some time.

4.3 EVAPORATOR COIL CLEANING

The use of recycled cardboard cartons is increasing. The recycled cardboard cartons create much more fiber dust during transport than "new" cartons. The fiber dust and particles are drawn into the evaporator where they lodge between the evaporator fins. If the coil is not cleaned on a regular basis, sometimes as often as after each trip, the accumulation can be great enough to restrict air flow, cause coil icing, repetitive defrosts and loss of unit capacity. Due to the "washing" action of normal defrost the fiber dust and particles may not be visible on the face of the coil but may accumulate deep within.

It is recommended to clean an the evaporator coil on a regular basis, not only to remove cardboard dust, but to remove any grease oil film which sometimes coats the fins and prevents water from draining into the drain pan.

Cardboard fiber particles after being wetted and dried several times can be very hard to remove. Therefore, several washings may be necessary.

a. Spray coil with a mild detergent solution such as any good commercial-grade automatic dish washer detergent and let the solution stand for a few minutes. Reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. Make sure drain lines are clean.

b. Run unit until defrost mode be initiated to check for proper draining from drain pan.

4.4 CONDENSER COIL CLEANING

Remove all foreign material from the condenser coil by reversing the normal air flow. (Air is pulled in through the front.) Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

4.5 CHECKING AND REPLACING FILTER-DRIER

Checking filter-drier

Check for any obstruction of the filter-drier by feeling the inlet and outlet connections of the liquid line on the filter cartridge. If the temperature of the outlet connection seems lower than the temperature of the inlet connection, replace the filter-drier.

Replacing the filter-drier

Pump the unit down (refer to paragraph 4.7.2). Remove the drier mounting clip, then replace the filter-drier. Following drier replacement, evacuate and recharge unit (refer to paragraphs 4.9.4 & 4.10.3).

4.6 CHECKING THE TXV ORIFICE STRAINER

Pump the unit down (refer to paragraph 4.7.2). Remove the bottom connection on the TXV. Remove the strainer and check for obstruction or damage. Clean or replace strainer assembly and tighten connection at bottom of valve. Evacuate and recharge unit (refer to paragraphs 4.9.4 & 4.10.3).

Road compressor oil type: The road compressors are supplied with CARRIER POLYESTER (POE) oil. Ensure compressor is marked with a factory sticker indicating the correct oil has been installed. Oils of PAG type are **strictly incompatible** with the operation of this unit, **never use an oil other than that approved by CARRIER**.

4.7 REMOVING THE REFRIGERANT CHARGE

4.7.1 Removing Complete Charge

Connect a refrigerant recovery system to the unit to remove refrigerant charge. Refer to instruction provided by the manufacture of the refrigerant recovery system.

4.7.2 Pumping The Unit Down

If standby power is available and to service the filter-drier, moisture-liquid indicator, liquid line check valve, expansion valve, quench valve, evaporator coil, compressor pressure regulating valve or the road compressor pump the refrigerant into the high side as follows:

a. Attach manifold gauge set to standby compressor service valves.

b. Start the unit and run in standby cooling mode for 10 to 15 minutes. Frontseat the liquid line service valve. Place the emergency switch in the OFF position when the suction reaches a positive pressure of 1.0 psig (0.01 bar).

c. Frontseat the standby suction service valve. The refrigerant will be trapped between the standby compressor suction service valve and the liquid line valve.

d. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge. If a vacuum is indicated, emit refrigerant by cracking the liquid line valve momentarily to build up a slight positive pressure.

e. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation which puts moisture in the system.

f. After repairs have been made, be sure to perform a refrigerant leak check (refer to paragraph 4.8), and evacuate and dehydrate the low side (refer to paragraph 4.9.4).

g. Check refrigerant charge (refer to paragraph 4.10.1).

4.8 REFRIGERANT LEAK CHECKING

a. The recommended procedure for finding leaks in a system is with an electronic leak detector. Testing joints with soapsuds is satisfactory only for locating large leaks.

NOTE

Only refrigerant 404A should be used to pressurize the system. Any other gas or vapor will contaminate the system which will require additional purging and evacuation of the system.

b. If system is without refrigerant or the low side has been pumped down, charge with refrigerant 404A to build up pressure between 30 and 50 psig (2 to 3.4 bar). Remove refrigerant cylinder and leak check all connections.

c. Remove test refrigerant using a refrigerant recovery system and repair any leaks. Evacuate and dehydrate the unit or low side as applicable. (Refer to paragraph 4.9) Charge unit with refrigerant. (Refer to paragraph 4.10)

4.9 EVACUATION AND DEHYDRATION

4.9.1 General

Moisture is the deadly enemy of refrigerant systems. The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, “freezing-up” of metering devices by free water, and formation of acids, resulting in metal corrosion.

4.9.2 Preparation

a. Evacuate and dehydrate only after pressure leak test. (Refer to paragraph 4.8).

b. Essential tools to properly evacuate and dehydrate include a good vacuum pump (5cfm = 8m^3/h volume displacement) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator). The tools are available from Carrier Transicold. For the pump, order part number 07−00176−11 and for the indicator order part number 07−00414−00.

NOTE

Use of a compound gauge is not recommended because of its inherent inaccuracy.

c. If possible, keep the ambient temperature above 60°F (15.6°C) to speed evaporation of moisture. if ambient temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature.

d. Additional time may be saved during a complete system pump down by replacing the filter−drier with a section of copper tubing and the appropriate fittings. Installation of a new filter−drier may be performed during the charging procedure.

4.9.3 Evacuation and Dehydration − Complete System.

a. Remove refrigerant using a refrigerant recovery system.

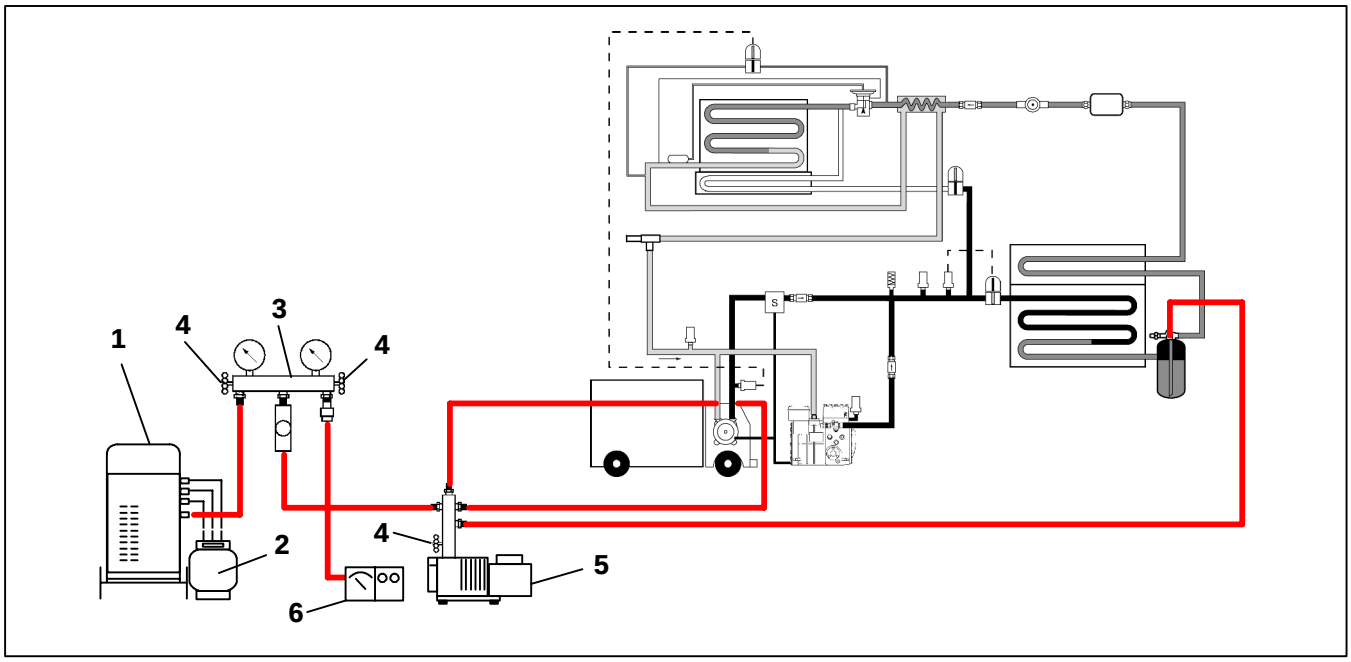
b. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses to the vacuum pump and refrigeration unit as shown in Figure 4-2. (do not use standard service hoses as they are not suited for evacuation purposes). Also, as shown, connect an evacuation manifold with special evacuation hoses to the vacuum pump, to the electronic vacuum gauge and to the refrigerant recovery system.

c. Test the evacuation system for leaks by backseating the unit service valves and drawing a deep vacuum with the vacuum pump and gauge valves open. Shut off the pump and check to see if the vacuum holds. Repair leaks if necessary.

d. Midseat the refrigerant system service valves.

e. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.

f. Break the vacuum with clean dry refrigerant 404A. Raise system pressure to approximately 2 psig (0.14 bar).



1 Refrigerant Recovery Unit
2 Refrigerant Cylinder
3 Evacuation Manifold
4 Valve
5 Vacuum Pump
6 Electronic Vacuum Gauge

Figure 4-2. Vacuum Pump Connection

g. Remove refrigerant using a refrigerant recovery system.

h. Repeat steps e. to g.

i. If required, remove the copper tubing and install a new filter-drier. Evacuate unit to 500 microns. Close off vacuum pump valve and stop pump. Wait five minutes to see if vacuum holds. This checks for residual moisture and/or leaks.

j. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. Continue to paragraph 4.10.2.

4.9.4 Evacuation and Dehydration - Partial System.

a. If the refrigerant charge has been removed from the standby compressor for service, evacuate only the compressor by connecting the evacuation set-up at the compressor service valves. Follow evacuation procedures of the preceding paragraph except leave compressor service valves frontseated until evacuation is completed.

b. If refrigerant charge has been removed from the low side only, evacuate the low side by connecting the evacuation set-up at the standby compressor suction service valve and liquid service valve except leave the service valves frontseated until evacuation is completed.

c. Once evacuation has been completed and the pump has been isolated, fully backseat the service valves to isolate the service connections and then continue with checking and, if required, adding refrigerant in accordance with normal procedures

4.10 CHARGING THE REFRIGERATION SYSTEM

4.10.1 Checking The Refrigerant Charge

Start unit in cooling mode. Run approximately ten minutes. Partially block off air flow to condenser coil increase the area blocked until compressor discharge pressure is raised to approximately 325 psi (22 bars).

The charge is correct if there are no bubbles at the liquid line sight glass.

4.10.2 Installing A Complete Charge

a. Evacuate the refrigeration circuit and leave in a deep vacuum (refer to paragraph 4.9).

b. Place a refrigerant 404A cylinder on scale and connect charging line from cylinder to manifold. Purge charging line at outlet valve. Purge charging line at inlet manifold.

c. Note weight of refrigerant cylinder.

d. Open liquid valve on refrigerant cylinder. Open liquid line service valve half way and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. (Correct charge will be found in paragraph 1.2).

NOTE

It may be necessary to finish charging the unit using the partial charge method, due to pressure rise in the high side of the system. (Refer to paragraph 4.10.3)

e. When refrigerant cylinder weight (scale) indicates that the correct charge has been added, close the manifold valves.

f. Open the receiver valve back seat and check charge in accordance with paragraph 4.10.1.

4.10.3 Adding A Partial Charge

a. Place refrigerant cylinder on scale and note weight.

b. Connect charging line from the cylinder to the receiver valve. Purge the line at the cylinder valve.

c. Start the unit with the road compressor turning at 2400 rpm.

d. Front seat the liquid line service valve.

CAUTION

Refrigerant R404A must be charged as a liquid. Refrigerant R404A is a blend. Charging as a vapor will change the properties of the refrigerant.

e. Add a small quantity of refrigerant.

f. Back seat the receiver valve.

g. Follow the procedures of paragraph 4.10.1 and add refrigerant as required to clear the sight glass.

4.11 REPLACING THE COMPRESSOR

a. For the road compressor, remove the refrigerant charge. Refer to paragraph 4.7.1. For the standby compressor, pump the unit down. Refer to paragraph 4.7.2.

WARNING

Ensure power to the unit is OFF and power plug is disconnected or vehicle engine is OFF and negative battery cable is disconnected before replacing the compressor.

WARNING

Slowly open the plug on the suction and discharge valves to vent the nitrogen holding charge.

b. for the standby compressor, follow wiring diagrams provided herein and on inside of terminal box cover.

c. Installation

d. To install the compressor, reverse the removal procedure. Refer to paragraph 1.5 for torque values.

e. Evacuate and dehydrate, see paragraph 3.5 then charge system, see paragraph 4.10.

4.12 HIGH PRESSURE OR CONDENSER PRESSURE SWITCH

4.12.1 Removing Switch

a. A schreader valve is located under each switch to allow removal and installation without removing the refrigerant charge.

b. Remove switch and test in accordance with paragraph 4.12.2.

c. Replace or reinstall switch.

4.12.2 Checking Pressure Switch

WARNING

Do not use a nitrogen cylinder without a pressure regulator. (See Figure 4-3.) Cylinder pressure is approximately 2350 psi (160 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur.

a. Remove switch as outlined in paragraph 4.12.1.

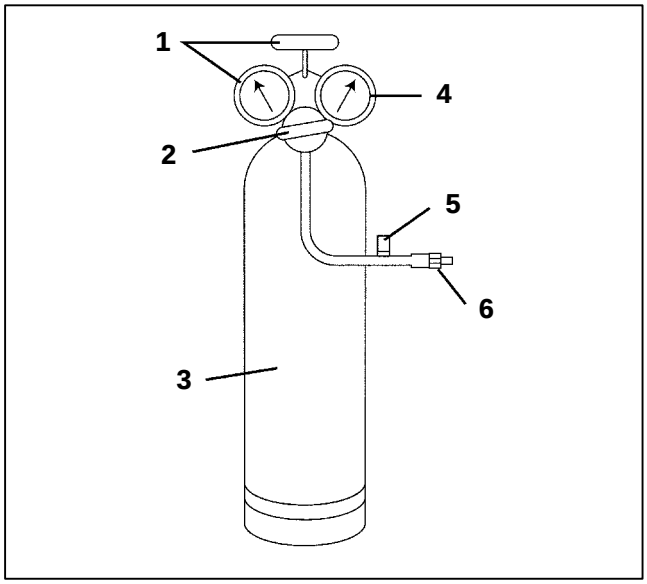
b. For the High and condenser pressure switches, connect switch to a cylinder of dry nitrogen (see Figure 4-3.). For the low pressure switch, connect to a vacuum pump and gauge. Test low pressure switch using method similar to that described in the following steps for the pressure switches.

c. Set nitrogen pressure regulator higher than cut-out (HP–1 or HP–3) or cut in (HP–2) point on switch being tested. Pressure switch settings points are provided in paragraph 1.3.

d. Close valve on cylinder and open bleed-off valve.

e. Open cylinder valve. While observing indicator (light or meter), slowly close bleed-off valve and increase pressure until the switch opens (HP–1 or HP–3) or closes (HP–2). Slowly open bleed-off valve (to decrease pressure) until switch reverts to normal position.

f. If switch does not activate within tolerances provided, replace switch. Test new switch before installation.

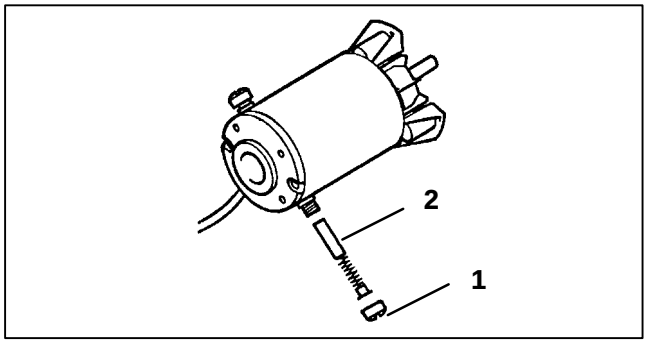


1. Cylinder valve and gauge
2. Pressure regulator
3. Nitrogen cylinder
4. Pressure gauge (0 to 400 psig = 0 to 28 bars)
5. Bleed-off valve
6. 1/4 inch connection

Figure 4-3. Typical Setup For Testing Pressure Switches HP1, HP2 and HP3

4.13 CHECKING AND REPLACING CONDENSER FAN MOTOR BRUSHES

To maintain proper operation of the fan motors, the fan motor brushes should be checked periodically for cleanliness and wear .



1. Brush Cap 2. Brush

Figure 4-4. Fan motor brushes

To check brushes proceed as follows :

a. With unit off and battery disconnected, remove brush cap (item 1, Figure 4-4.; 2 per motor).

b. Remove brushes (item 2; 2 per motor) and check the length of the brush. If the length is less than 1/4 inch (6 mm) the brushes should be replaced.

c. Blow out the brush holder with low pressure air to remove any carbon dust in the holder. This dust could prevent a good contact between the brushes and comutator.

d. Remove the back cover of the motor and inspect the comutator. If the comutator is heavily grooved, polish it using fine sandpaper; do not use abrasive paper. Wipe out any accumulation of greasy material using a clean rag dampened with solvent. Reassemble the motor; install new brushes and replace cap.

4.14 HOT GAS AND CONDENSER PRESSURE CONTROL SOLENOID VALVES

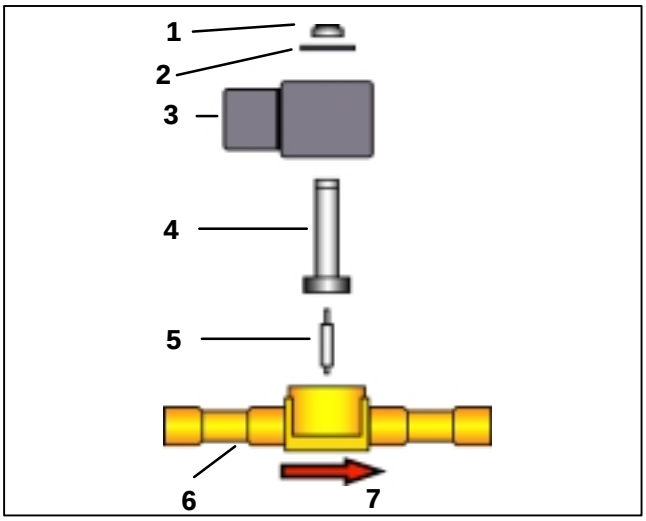
4.14.1 Replacing Solenoid Coil

It is not necessary to remove the refrigerant charge when replace the coil (see Figure 4-5.).

a. Remove coil snap cap, voltage plate and coil assembly. Disconnect leads and remove coil junction box if necessary.

b. Verify coil type, voltage and frequency. This information appears on the coil voltage plate and the coil housing.

c. Place new coil over enclosing tube and then install voltage plate and snap cap.



1. Snap cap
2. Voltage plate
3. Coil assembly
4. Enclosing tube
5. Plunger assembly
6. Valve body assembly
7. Direction of flow

Figure 4-5. Hot Gas or Condenser Pressure Control Solenoid

4.14.2 Replacing Valve Internal Parts

a. Remove the refrigerant charge. (Refer to paragraph 4.7).

b. Remove coil snap cap, voltage cover and coil assembly. Remove the enclosing tube.

c. Check for foreign material in valve body.

d. Check for damaged plunger and O-ring. If O-ring is to be replaced, always put refrigerant oil on O-rings before installing.

CAUTION

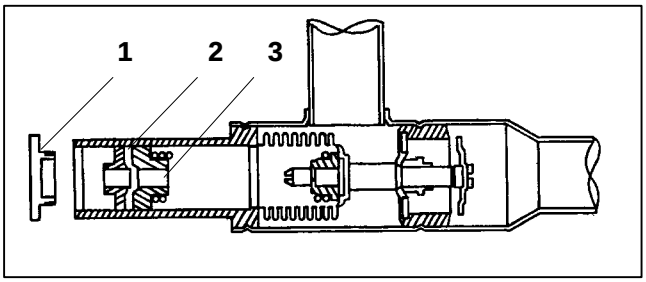
Do not damage or over tighten the enclosing tube assembly. Also make sure all parts are placed in the enclosing tube in proper sequence to avoid premature coil burn-out.

e. Tighten enclosing tube.

f. Install coil assembly, voltage cover and snap cap.

g. Evacuate, dehydrate and recharge unit. Refer to paragraphs 4.9.3 and 4.10.2.

h. Start unit and check operation.



1. Cap
2. Jam Nut
3. Set Screw

Figure 4-6. Compressor Pressure Regulating Valve

4.15 ADJUSTING THE COMPRESSOR PRESSURE REGULATING VALVE (CPR)

When adjusting the compressor pressure regulating valve (CPR) (see Figure 4-6.), the unit must be running in heating or defrost mode. This will ensure a suction pressure above the proper CPR setting. To adjust the CPR valve, proceed as follows :

a. Install a gauge on the suction line .

b. Remove cap from CPR valve.

c. With an 8 mm Allen wrench, loosen the jam nut.

d. Using the 8 mm Allen wrench, adjust the set screw. To raise the suction pressure turn the set screw clockwise; to lower the suction pressure, turn counterclockwise. Refer to paragraph 1.3 for CPR valve setting.

e. When the setting has been adjusted, tighten the jam nut securely against the set screw. This will prevent any movement of the set screw due to vibrations in the unit. Replace the cap.

4.16 THERMOSTATIC EXPANSION VALVE

The thermal expansion valve is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. In addition, this valve is of the Maximum Operating Pressure type. Valves with MOP, will limit the rise of suction pressure above set point in order to avoid overloading of the compressor.

Unless the valve is defective, it requires no adjustment, but maintenance must be done every year in order to clean the orifice strainer. Refer to paragraph 4.6.

4.16.1 Replacing expansion valve

a. Pump the unit down. Refer to paragraph 4.7.2.

b. Remove insulation from expansion valve bulb and then remove bulb from suction line.

c. Loosen inlet nut and unbraze equalizer line and outlet line from expansion valve.

d. The thermal bulb is located below the center of the suction line. This area must be clean to ensure positive bulb contact. Strap thermal bulb to suction line and insulate both.

e. Braze the equalizer tubes to expansion valve.

f. Evacuate, dehydrate and recharge unit.

g. Check superheat (refer to paragraph 1.3).

4.16.2 Measuring superheat

a. Remove insulation from expansion valve bulb and suction line. See Figure 4-7.

b. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

c. Place thermocouple above (parallel to) the TXV bulb and then secure loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 4-7.

d. Connect an accurate gauge to the ¼" port on the suction service valve.

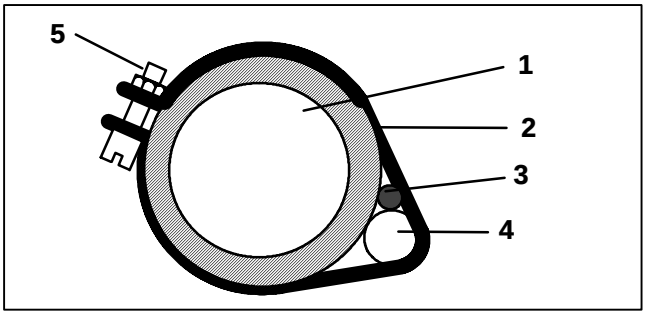
e. Run unit until stabilized at –4_F (-20_C) box temperature.

f. From the temperature/pressure chart (Table 4-3), determine the saturation temperature corresponding to the evaporator outlet pressure.

g. Note the temperature of the suction gas at the expansion valve bulb.

h. Subtract the saturation temperature determined in Step f. from the average temperature measured in Step g.. The difference is the superheat of the suction gas. Refer to paragraph 1.3 for superheat setting.

i. If required adjust superheat by turning the adjusting screw located under the cap on the side of the valve.



1. Suction Line (end view)
2. TXV Bulb Clamp
3. Thermocouple
4. TXV Bulb
5. Nut and Bolt (Clamp)

Figure 4-7. Thermostatic Expansion Valve Bulb And Thermocouple

4.17 MICROPROCESSOR

Although there is less danger of electrical static discharge (ESD) damage in the outdoor environment, where the processor is likely to be handled, proper board handling techniques should be stressed. Boards should always be handled by their edges, in much the same way one would handle a photograph. This not only precludes the possibility of ESD damage, but also lowers the possibility of physical damage to the electronic components. Although the microprocessor boards are fairly rugged when assembled, they are more fragile when separated and should always be handled carefully.

When welding is required on the unit frame, or on the front area of the trailer, ALL wiring to the microprocessor MUST be disconnected. When welding is performed on other areas of the truck and van, the welder ground connection MUST be in close proximity to the area being welded. It is also a good practice to remove both battery cables before welding on either the unit frame or the truck to prevent possible damage to other components such as the alternator and voltage regulator.

Table 4-3. R-404A Temperature–Pressure Chart

Temperature		Pressure			Temperature		Pressure		
_F	_C	Psig	Kg/cm^2	Bar	_F	_C	Psig	Kg/cm^2	Bar
–40	–40	4.5	0.32	0.31	32	0	72.5	5.10	5.00
–35	–37	7.1	0.50	0.49	34	1	75.6	5.32	5.21
–30	–34	9.9	0.70	0.68	36	2	78.8	5.54	5.43
–25	–32	12.9	0.91	0.89	38	3	82.1	5.77	5.66
–20	–29	16.3	1.15	1.12	40	4	85.5	6.01	5.90
–18	–28	17.7	1.24	1.22	42	6	89.0	6.26	6.14
–16	–27	19.2	1.35	1.32	44	7	92.5	6.50	6.38
–14	–26	20.7	1.46	1.43	46	8	96.2	6.76	6.63
–12	–24	22.3	1.57	1.54	48	9	99.9	7.02	6.89
–10	–23	23.9	1.68	1.65	50	10	103.7	7.29	7.15
–8	–22	25.6	1.80	1.77	55	13	115.4	8.11	7.96
–6	–21	27.3	1.92	1.88	60	16	126.1	8.87	8.69
–4	–20	29.1	2.05	2.01	65	18	137.4	9.66	9.47
–2	–19	30.9	2.17	2.13	70	21	149.4	10.50	10.30
0	–18	32.8	2.31	2.26	75	24	162.1	11.40	11.18
2	–17	34.8	2.45	2.40	80	27	175.5	12.34	12.10
4	–16	36.8	2.59	2.54	85	29	189.6	13.33	13.07
6	–14	38.9	2.73	2.68	90	32	204.5	14.38	14.10
8	–13	41.1	2.89	2.83	95	35	220.2	15.48	15.18
10	–12	43.3	3.04	2.99	100	38	236.8	16.65	16.33
12	–11	45.6	3.21	3.14	105	41	254.2	17.87	17.53
14	–10	48.0	3.37	3.31	110	43	272.4	19.15	18.78
16	–9	50.4	3.54	3.47	115	46	291.6	20.50	20.11
18	–8	52.9	3.72	3.65	120	49	311.8	21.92	21.50
20	–7	55.5	3.90	3.83	125	52	332.9	23.41	22.95
22	–6	58.1	4.08	4.01	130	54	355.0	24.96	24.48
24	–4	60.9	4.28	4.20	135	57	378.1	26.58	26.07
26	–3	63.7	4.48	4.39	140	60	402.3	28.28	27.74
28	–2	66.5	4.68	4.59	145	63	427.6	30.06	29.48
30	–1	69.5	4.89	4.79	150	66	454.0	31.92	31.30

SECTION 5

SCHEMATIC DIAGRAMS

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and operating compressor unexpectedly as control requirements dictate. To ensure unit will not start, place the EMERGENCY SWITCH (see Figure 1-1) in the OFF position. To ensure unit is without power, remove power plug and remove battery negative cable.

5.1 INTRODUCTION

Schematic diagrams for the unit models listed in Table 1-1 are provided herein.

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL
B-12	BPT	INJECTION KLIXON	ROAD COMPRESSOR
J-5	BPV	INJECTION VALVE SOLENOID	EVAPORATOR
B-6	CC	CAB COMMAND	CAB
B-4	CFM	CONDENSER FAN MOTOR	CONDENSER
B-11	CLHR	ROAD ELECTROMAGNETIC CLUTCH	ENGINE COMPARTMENT
B-12	DS	DOOR SWITCH (OPTION)	EXTERNAL
J-2	DTT	DEFROST KLIXON	EVAPORATOR
J-5	DWR	DRAIN WATER RESISTOR (OPTION)	EVAPORATOR
B-9	EB	EMERGENCY SWITCH	CONDENSER
J-7/J-8/J-9	EFM1,2,3	EVAPORATOR FANS MOTORS	EVAPORATOR
B-10	FI	FUSE IGNITION	ENGINE COMPARTMENT
A-13/C-13	FR,FR1	FUSE ROAD (DC VOLTAGE)	CONDENSER/BATTERY
B-3	HP1	SECURTITY PRESSURE SWITCH	CONDENSER
B-4	HP2	CONDENSER FAN CYCLE SWITCH	CONDENSER
B-5	HGS1	HOT GAS SOLENOID DEFROST	CONDENSER
B-5	HGS2	HOT GAS SOLENOID HEATING (OPTION)	CONDENSER
J-6	HWV	HEATING WATER VALVE (OPTION)	EXTERNAL
K-6	HWP	HEATING WATER PUMP (OPTION)	EXTERNAL
B-10	IGNITION	SWITCH KEY INFORMATION (IGNITION)	ENGINE COMPARTMENT
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
F-2	MP	MICROPROCESSOR BOARD	CONDENSER
J-3	RAS	RETURN AIR SENSOR	EVAPORATOR

SP INDICATES A SOLDERED SPLICE POINT.

T1 PIN CONNECTION.

LIGHT LINES INDICATES WIRES IN THE SYSTEM.

NORMALLY CLOSED CONTACTS.

NORMALLY OPEN CONTACTS.

HC-F2 MULTIPLE PLUG CONNECTION NUMBER.

B1 JUNCTION BLOCK CONNECTION

SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.

INDICATES A WIRE GROUND.

INDICATES A CHASSIS GROUND (NO WIRE).

INDICATES OPTIONS.

INDICATES A CONNECTION,WIRE,LUG,ETC.

INSULATING PLUG

1 COMPONENT CONNECTION NUMBER OR LETTER.

STP SWITCH THERMAL PROTECTOR (TOPFET)

NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUNDS
   RED - DC BATTERY PLUS
   BLACK - DC BATTERY MINUS
   ORANGE - AC CIRCUITS
   GREEN/YELLOW- AC EARTH
   DARK BLUE - AC CIRCUITS PHASE1
   BLACK - AC CIRCUITS PHASE2
   BROWN - AC CIRCUITS PHASE3
3. ADDRESS SYSTEM: EXAMPLE: MP-43/C8-A, INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PIN A).
4. ACCORDING TO EVAPORATOR CONFIGURATION
5. STANDARD ON THE 50S, OPTIONNAL FOR OTHER.

CHART 1	FI	FR	FR1
+BAT = +12V	1A	50A	60A
+BAT = +24V	1A	40A	50A

BASED ON DRAWING 62-60873, REVISION C
MODIFIED FOR SERVICE MANUAL

Figure 5-1. Schematic Diagram – Road Only (Page 1 of 2)

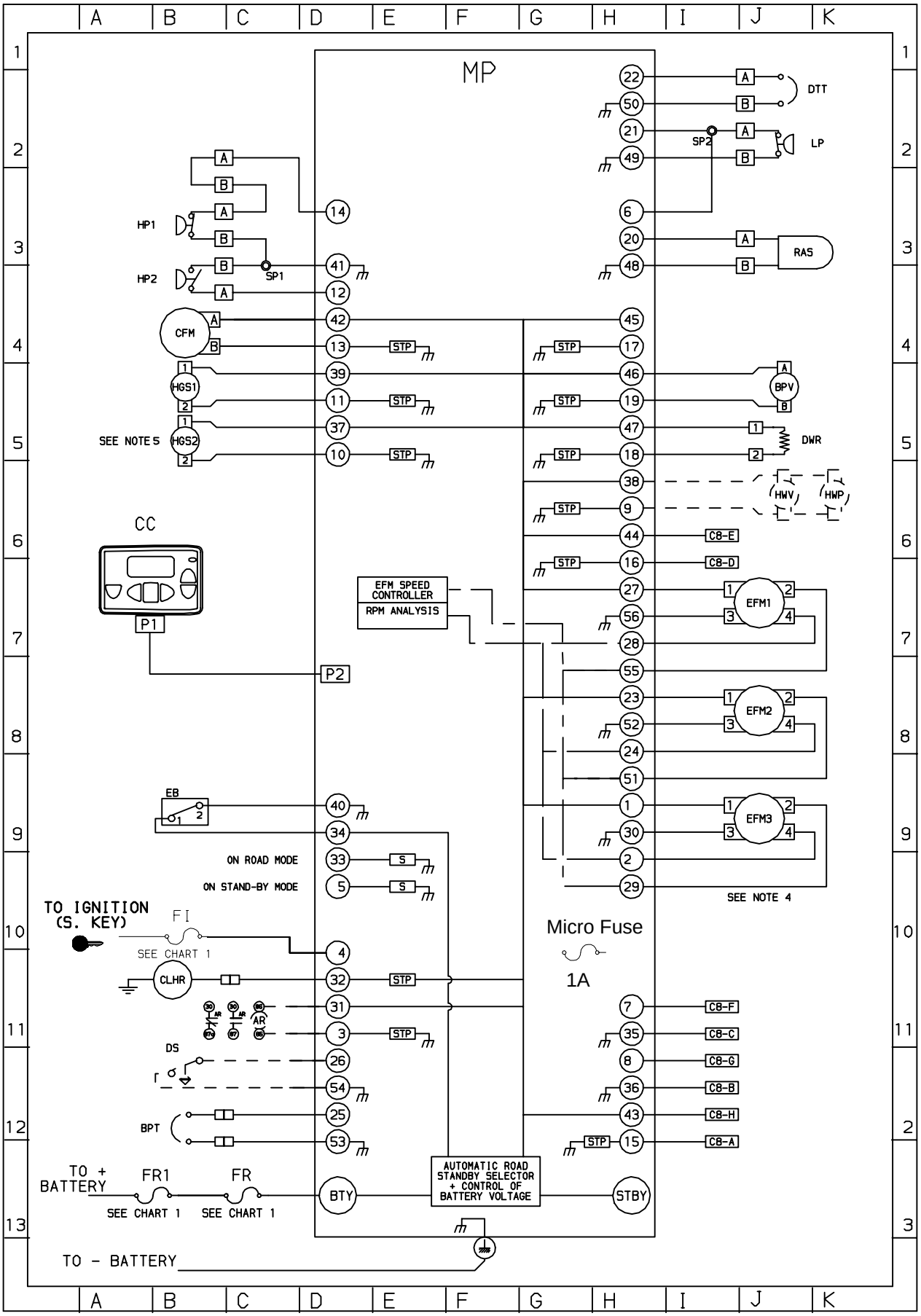


Figure 5-1. Schematic Diagram – Road OnlY
(Page 2 of 2)

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL
B-12	BPT	INJECTION KLIXON	ROAD COMPRESSOR
J-5	BPV	INJECTION VALVE SOLENOID	EVAPORATOR
B-6	CC	CAB COMMAND	CAB
B-4	CFM	CONDENSER FAN MOTOR	CONDENSER
B-11	CLHR	ROAD ELECTROMAGNETIC CLUTCH	ENGINE COMPARTMENT
B-12	DS	DOOR SWITCH (OPTION)	EXTERNAL
J-2	DTT	DEFROST KLIXON	EVAPORATOR
J-5	DWR	DRAIN WATER RESISTOR (OPTION)	EVAPORATOR
B-9	EB	EMERGENCY SWITCH	CONDENSER
J-7/J-8/J-9	EFM1,2,3	EVAPORATOR FANS MOTORS	EVAPORATOR
N-9	F1,2,3	FUSE FOR PRIMARY SOLENOID TRANSFORMER	STANDBY BOX
N-4	FB	FUSE BLOCK	STANDBY BOX
B-10	FI	FUSE IGNITION	ENGINE COMPARTMENT
A-13/C-13	FR,FR1	FUSE ROAD (DC VOLTAGE)	CONDENSER/BATTERY
I-13	FS	FUSE STANDBY (DC VOLTAGE)	CONDENSER
B-3	HP1	SECURTITY PRESSURE SWITCH	CONDENSER
B-4	HP2	CONDENSER FAN CYCLE SWITCH	CONDENSER
B-3	HP3	SECURITY PRESSURE SWITCH STANDBY	CONDENSER
B-5	HGS1	HOT GAS SOLENOID DEFROST	CONDENSER
B-5	HGS2	HOT GAS SOLENOID HEATING (OPTION)	CONDENSER
J-6	HWV	HEATING WATER VALVE (OPTION)	EXTERNAL
K-6	HWP	HEATING WATER PUMP (OPTION)	EXTERNAL
B-10	IGNITION	SWITCH KEY INFORMATION (IGNITION)	ENGINE COMPARTMENT
R-8	KR	THERMAL PROTECTION FOR STANDBY COMPRESSOR	STANDBY BOX
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
J-12/N-6	MC	CONTACTOR	STANDBY BOX
F-2	MP	MICROPROCESSOR BOARD	CONDENSER
P-4/P-3	PSR	POWER SUPPLY RECEPTACLE	EXTERNAL
Q-7	PTC SENSOR	THERMAL SENSOR IN SBM	COMPRESSOR
J-3	RAS	RETURN AIR SENSOR	EVAPORATOR
O-12	RB	RECTIFIER BRIDGE	CONDENSER
Q-12	RBT	RECTIFIER BRIDGE THERMISTOR	RECTIFIER BRIDGE
R-6	SBM	STANDBY COMPRESSOR MOTOR	CONDENSER
Q-9	TR	TRANSFORMER	CONDENSER
R-11	TRT	TRANSFORMER THERMISTOR	TRANSFORMER

NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUNDS
   RED - DC BATTERY PLUS
   BLACK - DC BATTERY MINUS
   ORANGE - AC CIRCUITS
   GREEN/YELLOW- AC EARTH
   DARK BLUE - AC CIRCUITS PHASE1
   BLACK - AC CIRCUITS PHASE2
   BROWN - AC CIRCUITS PHASE3
3. ADDRESS SYSTEM: EXAMPLE: MP-43/C8-A, INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PIN A).
4. ACCORDING TO EVAPORATOR CONFIGURATION
5. STANDARD ON THE XARIOS 50S OR INTEGRA 50S, OPTIONNAL FOR OTHER.
6. FOR THE THREE WIRES, THE WIRE MARK ARE:
   C12-9/PHASE1; SP11/PHASE2; C12-7/PHASE3.

SP INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION.
LIGHT LINES INDICATES WIRES IN THE SYSTEM.
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
HC-F2 MULTIPLE PLUG CONNECTION NUMBER.
B1 JUNCTION BLOCK CONNECTION
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
- INDICATES OPTIONS.
INDICATES A CONNECTION,WIRE,LUG,ETC.
INSULATING PLUG
1 COMPONENT CONNECTION NUMBER OR LETTER.
STP SWITCH THERMAL PROTECTOR (TOPFET)

CHART 1	FR	FR1	FS	F1,2,3	CHART 2	FB
+BAT = +12V	50A	60A	50A	3,15A	f = 60Hz	16A

CHART 4	SBM	CHART 5	TR 12V	TR 24V
ALL VERSIONS	1.5KW	ALL VERSIONS	441VA	571VA

BASED ON DRAWING 62-60856, REVISION E
MODIFIED FOR SERVICE MANUAL

Figure 5-2. Schematic Diagram – Three Phase Stand By Units (Page 1 of 2)

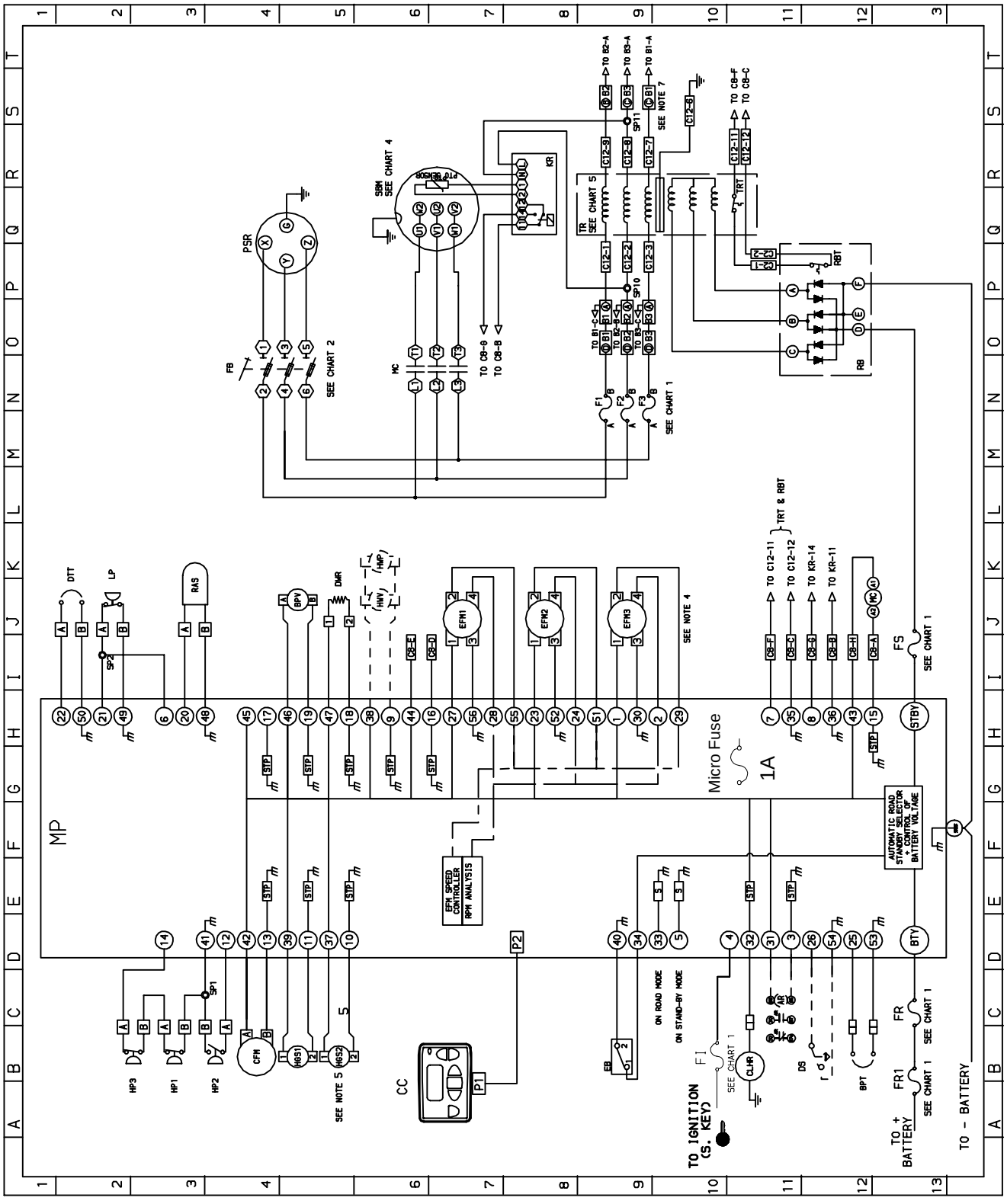


Figure 5-2. Schematic Diagram – Three Phase Stand By Units (Page 2 of 2)

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL
B-12	BPT	QUENCH (LIQUID INJECTION) THERMOSTAT	ROAD COMPRESSOR
J-5	BPV	QUENCH (LIQUID INJECTION) VALVE	EVAPORATOR
M-13	C1	CAPACITOR	CONDENSER
O-3	CB	CIRCUIT BREAKER	STANDBY PLUG BOX
B-6	CC	CAB COMMAND	CAB
B-4	CFM	CONDENSER FAN MOTOR	CONDENSER
B-11	CLHR	COMPRESSOR CLUTCH (ROAD)	ENGINE COMPARTMENT
Q-6	CP	RUN CAPACITOR	STARTING MOTOR BOX
R-6	CS1-2	START CAPACITOR	STARTING MOTOR BOX
B-12	DS	DOOR SWITCH (OPTION)	EXTERNAL
J-2	DTT	DEFROST TERMINATION THERMOSTAT	EVAPORATOR
J-5	DWR	EVAPORATOR DRAIN LINE HEATER	EVAPORATOR
B-9	EB	EMERGENCY SWITCH	CONDENSER
J-7/J-8/J-9	EFM1,2,3	EVAPORATOR FAN MOTOR	EVAPORATOR
M-9	F1	FUSE, TRANSFORMER	STANDBY BOX
B-10	FI	FUSE, IGNITION	ENGINE COMPARTMENT
A-13/C-13	FR/FR1	FUSE, ROAD (DC)	CONDENSER/BATTERY
I-13	FS	FUSE, STANDBY (DC)	CONDENSER
B-3	HP1	HIGH PRESSURE SWITCH	CONDENSER
B-4	HP2	CONDENSER PRESSURE CONTROL SWITCH	CONDENSER
B-3	HP3	HIGH PRESSURE SWITCH (STANDBY)	CONDENSER
B-5	HGS1	HOT GAS SOLENOID VALVE	CONDENSER
B-5	HGS2	CONDENSER PRESSURE CONTROL VALVE	CONDENSER
J-6	HWV	HOT WATER VALVE	EXTERNAL
K-6	HWP	HOT WATER PUMP	EXTERNAL
B-10	IGNITION	VEHICLE IGNITION KEY	ENGINE COMPARTMENT
O-8	KR	ELECTRONIC OVERLOAD RELAY	STANDBY BOX
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
J-12/N-7	MC	COMPRESSOR MOTOR CONTACTOR	STANDBY BOX
F-2	MP	MICROPROCESSOR	CONDENSER
O-7	PTO	THERMAL OVERLOAD	STANDBY MOTOR
P-4/P-2	PSR	POWER SUPPLY RECEPTACLE	STANDBY PLUG BOX
L-13	R	COMPRESSOR MOTOR THERMAL SENSOR	CONDENSER
J-3	RAS	RETURN AIR SENSOR	EVAPORATOR
N-12	RB	RECTIFIER BRIDGE	CONDENSER
P-12	RBT	RECTIFIER BRIDGE THERMISTOR	CONDENSER
R-6	RDCS	START CAPACITOR DISCHARGE RESISTOR	STARTING MOTOR BOX
O-6	SBM	STANDBY COMPRESSOR MOTOR	CONDENSER
Q-7	STR	START RELAY	STARTING MOTOR BOX
P-11	TR	TRANSFORMER	CONDENSER
P-12	TRT	TRANSFORMER THERMAL SENSOR	CONDENSER

NOTES :
1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS — ORANGE - AC CIRCUITS
   GREEN - DC GROUNDS — GREEN/YELLOW- AC EARTH
   RED - DC BATTERY PLUS — BLUE - AC CIRCUITS NEUTRAL
   BLACK - DC BATTERY MINUS — BROWN - AC CIRCUITS PHASE
3. ADDRESS SYSTEM: EXAMPLE: MP-43/C8-A, INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PIN A).
4. ACCORDING TO EVAPORATOR CONFIGURATION
5. STANDARD ON THE INTEGRA 50S, OPTIONNAL ON THE INTEGRA 40S

SP — INDICATES A SOLDERED SPLICE POINT.
T1 — PIN CONNECTION.
LIGHT LINES INDICATES WIRES IN THE SYSTEM.
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
HC-F2 — MULTIPLE PLUG CONNECTION NUMBER.
B1 — JUNCTION BLOCK CONNECTION
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES OPTIONS.
INDICATES A CONNECTION,WIRE,LUG,ETC.
INSULATING PLUG
1 — COMPONENT CONNECTION NUMBER OR LETTER.
STP — SWITCH THERMAL PROTECTOR (TOPFET)

CHART 1	FI	FR	FR1	FS	F1
+BAT = +12V	1A	50A	60A	50A	5 AT
+BAT = +24V	1A	40A	50A	40A	4 AT

CHART 4	SBM
XARIOS 500 INTEGRA 50S	1.5KW
XARIOS 400 INTEGRA 40S	1.5KW

CHART 5	TR
XARIOS 500 INTEGRA 50S	560VA
XARIOS 400 INTEGRA 40S	560VA

BASED ON DRAWING 62-60827, REVISION B MODIFED FOR SERVICE MANUAL

Figure 5-3. Schematic Diagram – Single Phase Stand By Units (Page 1 of 2)

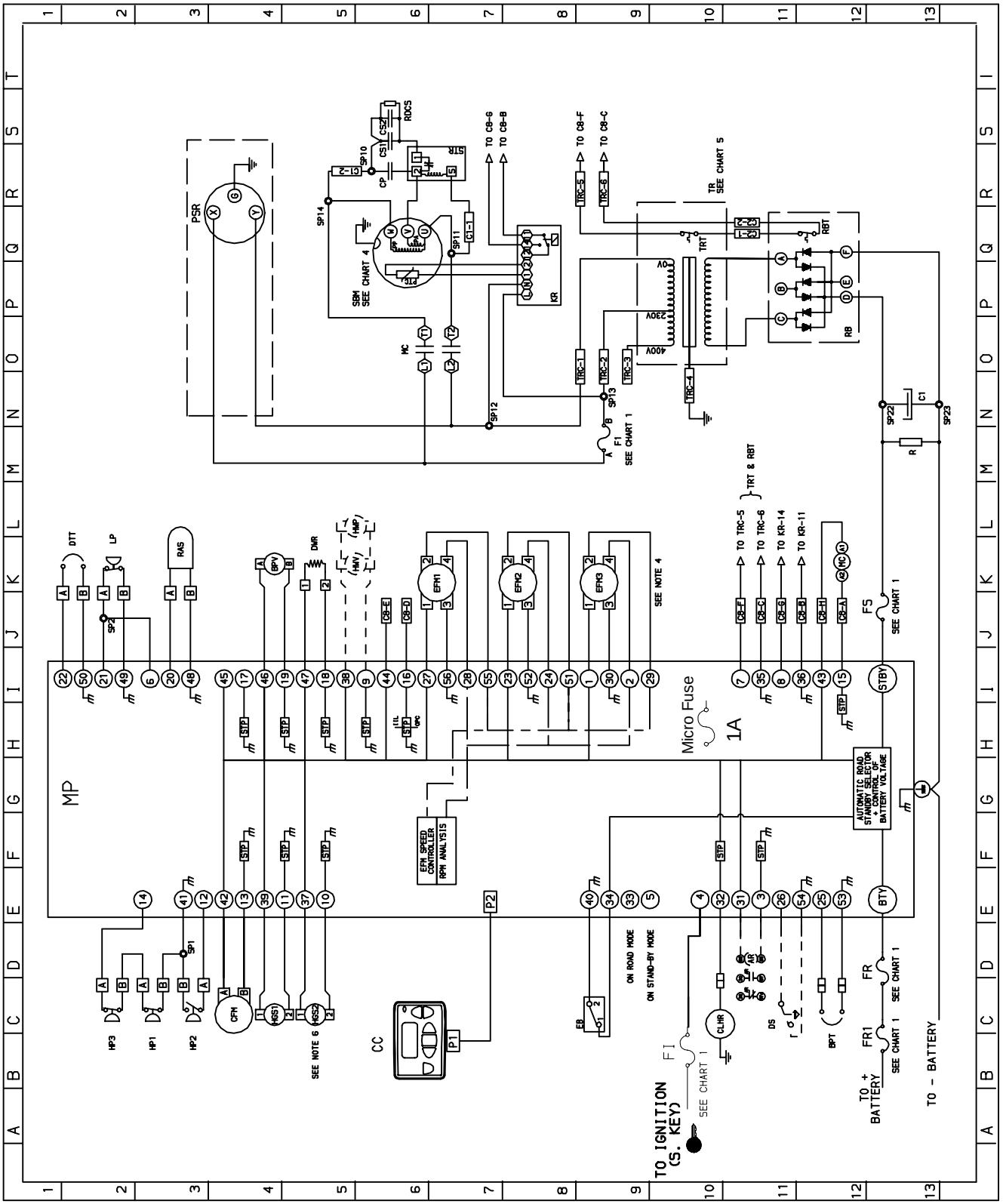


Figure 5-3. Schematic Diagram – Single Phase Stand By Units (Page 2 of 2)

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